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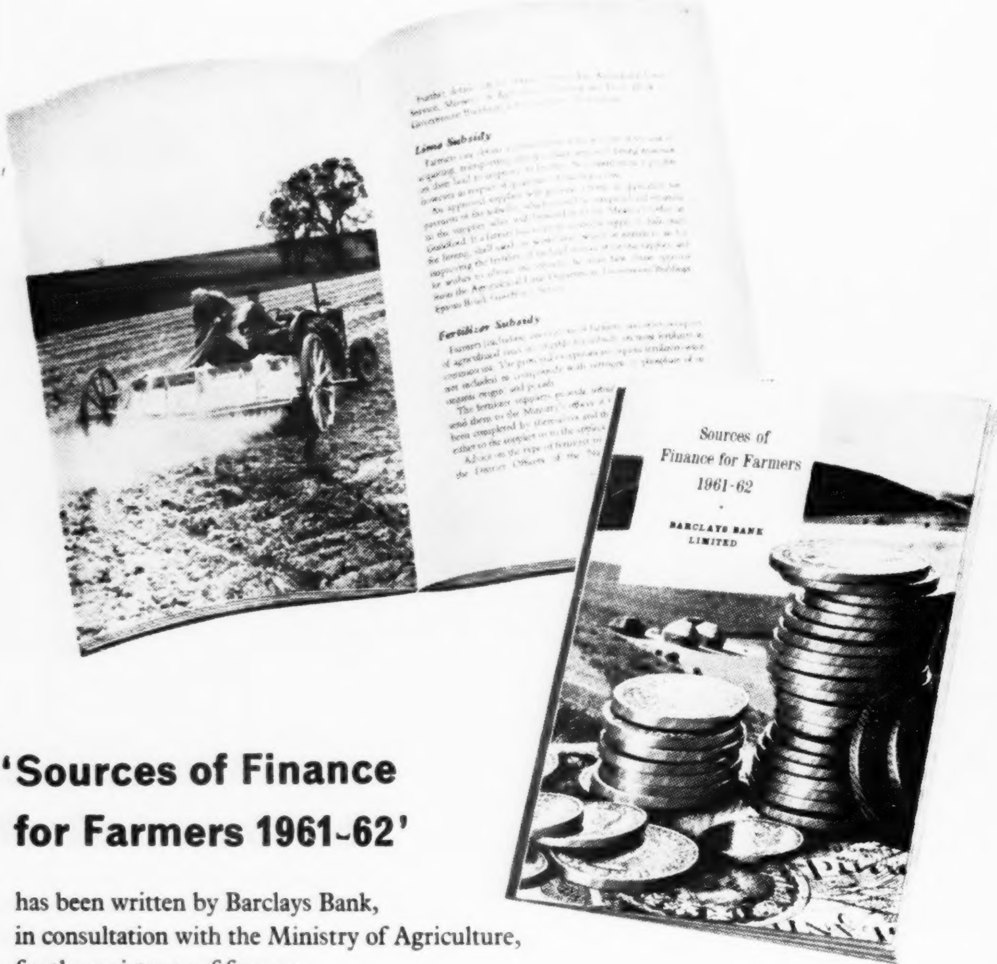

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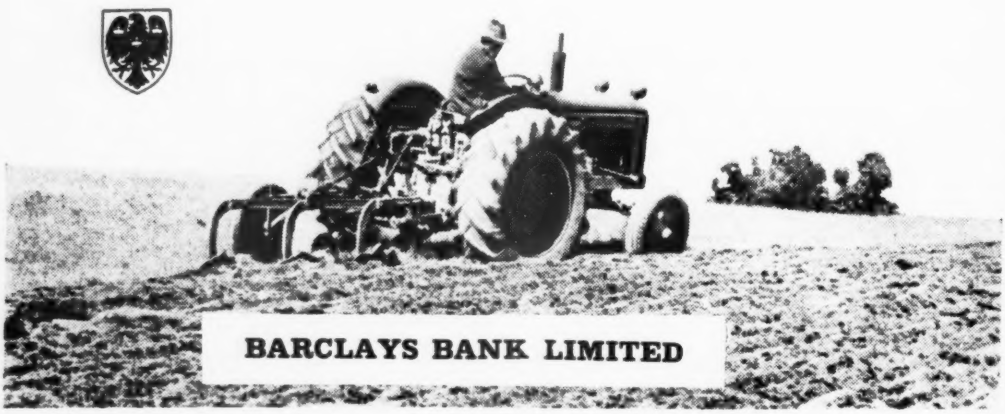


BALE HANDLING

As long as we have pick-up balers, bales must be handled. The rate at which bales are discharged is of particular interest to the man on the sledge. With increased baler outputs, the manned sledge prevents the baler from being used to its full capacity.

Recent N.I.A.E. Test Reports on Pick-up Balers show that average net rates of work have increased to 6·4 bales per minute for hay and 4·5 bales per minute for straw; at over 6 bales per minute, work on the sledge becomes too much for one man.

Another test report of a bale handling system, using a manned sledge and a transport unit consisting of tractor-mounted front and rear loaders, showed that the output of baler and sledge was 3–4 bales per minute, with one exception at 5–6 bales per minute. Also when using the transport unit the output of bales per man-hour was six to eight times that of hand loading.

It is often difficult to organize a gang to move bales. The use of an unmanned sledge releases a man to handle and stack bales mechanically at the side of the field for carting later. With two men, such a system clears the field quickly, allowing field work to continue.

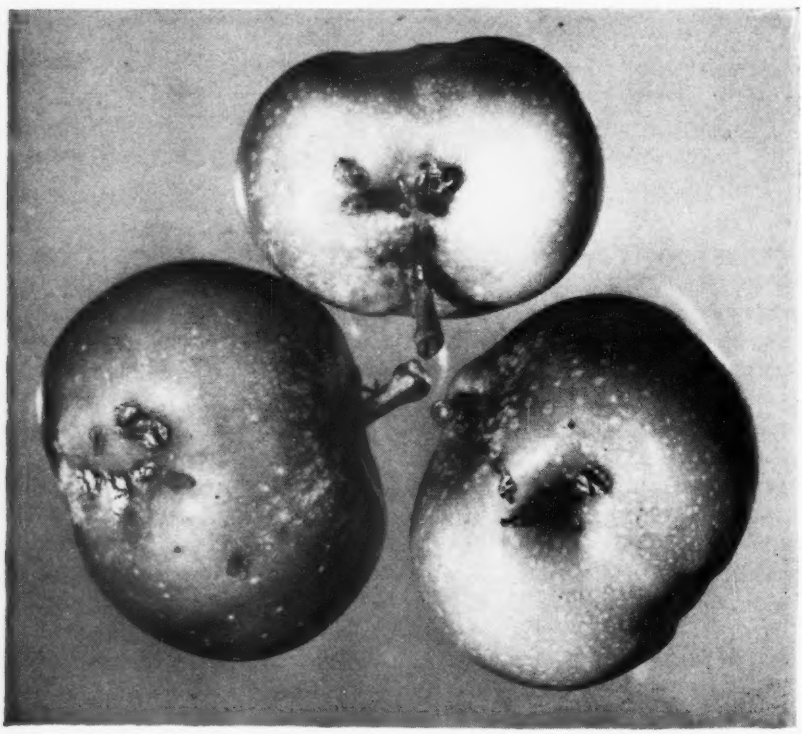
The Fruitlet Mining Tortrix

G. H. L. Dicker

This insect has appeared as a pest of apples in recent years. Once its presence has been recognized by the type of injury caused to the fruit, it can be easily controlled by sprays

THE fruitlet mining tortrix (*Pammene rhediella*) has long been known as a common British moth, but it is only since about 1955 that it has been recognized as a pest of cultivated fruits. Previously it interested only collectors, who discovered that moths were commonly to be seen flying over the tops of hawthorn trees on sunny days in May. The caterpillar was also found on the hawthorn, feeding on the flowers and unripe berries. It seems, therefore, that the hawthorn is the tortrix's normal food plant and that the spread to fruit trees has occurred only recently. Damage to apples was noticed in the Weald of Kent in the mid-fifties and subsequently in other fruit-growing areas. The caterpillars have also been found feeding on pear, plum and cherry fruits.

Fig. 1. Bramleys injured by fruitlet mining tortrix



Recognition of attack

The caterpillars live under cover and so are seldom seen by the fruit grower. Hence, the first indication of an infestation is usually when blemished fruits are noticed at harvest time. The identification of this pest thus depends very largely on the symptoms visible on the mature fruits. Diagnosis at this period is easy, provided the damage can be distinguished from that caused by two other species of tortrix moths—the summer fruit tortrix and the fruit tree tortrix.

Injury by the caterpillar of the fruitlet mining tortrix occurs in June when the fruits are small, either where the fruits of a cluster touch each other or where a leaf rests against the side of a fruit. At this period the injury consists of a small number of separate holes, often only a millimetre or so deep. Occasionally the larva also tunnels into the flesh and may reach the core. Deep tunnels follow a meandering course and so can be differentiated from attacks by codling moth and apply sawfly, in which the larva burrows straight towards the centre of the fruit. By harvest time the injured areas have developed a rough corky surface (Fig. 1) and the fruits are dimpled or misshapen due to subsequent growth being reduced in these areas.

The caterpillar of the summer fruit tortrix (*Adoxophyes orana*) feeds only on the skin (Fig. 2) and removes an irregular area of considerable size, over which thick corky tissue does not develop.

Damage by the fruit tree tortrix (*Archips podana*), or the surface-feeding tortrix as it is commonly called, occurs in September and early October. The young caterpillars feed where two fruits touch, or else web a leaf to the side of a fruit. Again, the injury is very shallow (Fig. 3) and is confined to a relatively small area.

Typical symptoms of the fruitlet mining tortrix on mature apple fruits therefore consist of corky patches over the feeding areas, and these are seen on the inner sides of fruits as arranged in the cluster.

Fig. 2. Miller's Seedling damaged by summer fruit tortrix

On cherry the infestation is noticed at picking time, bunches of fruits being webbed together, with the caterpillar often tunnelling around the stone. Symptoms are very similar on plums, but the fruits are still green at the time of attack.

Life history

We became aware of the identity of *Pammene rhediella* through reading reports of its life history and damage in Switzerland. Its habits appear to be very similar in England. The dark, coppery-coloured moths are active during the daytime and have been seen in flight over apple trees on sunny days during the blossom period. Often they will pass unnoticed. They have a wing span of only $\frac{3}{8}$ inch, and so can easily be mistaken for bees or flies. During the flight period, which probably continues for a week or two after the end of blossom, the small, translucent, scale-like eggs are laid on the rosette leaves, especially the undersides, or on the tiny fruits. Hatching begins in the week following petal-fall. In 1960 a few egg shells were found on 18th May, four days after petal-fall, and eggs collected on this date from orchards in north and mid-Kent hatched within a few days.

The young caterpillar prefers to feed on fruit. It can usually be found at the centre of a cluster, spinning copious webbing which binds the fruits together and includes such debris as dead petals and unfertilized blossoms. The entire larval life is passed within this protective web, the grub feeding on the accessible portions of the fruits. If an infested truss is inspected during June or July the fruits will be found to have a small number of shallow feeding holes and an occasional deeper tunnel.

Single fruits may be entered at the eye, or the larva may live amongst webbing at the stalk end. Alternatively, the larva may live under a leaf webbed to the side of a fruit, or it may feed on foliage or tunnel in young shoots if no fruit is available.

Fig. 3. Bramleys affected by the fruit tree tortrix

The caterpillar is whitish with a black head until it reaches the last stage, when the head becomes brown. It is considerably smaller than either the codling moth or apple sawfly, measuring about $\frac{3}{8}$ inch long at maturity. By late June or early July it is fully fed and seeks shelter under loose bark or in a similar sheltered position. Here a stout cocoon is spun and the larva goes into a resting stage until changing into a pupa the following spring. There is only one generation each year.

Control

The only information about control comes from results obtained by growers. Both DDT and Rhothane have proved effective when applied at petal-fall or during the 7–10 day period following the end of the blossom period. The results suggest that one or two annual applications can eradicate an infestation, provided hawthorn hedges adjoining orchards are also sprayed to remove sources of reinfestation.

I am extremely grateful to Mr. P. D. Scott and Dr. J. R. Chiswell for some of the information contained in this article.

Dr. G. H. L. Dicker is Head of the Entomology Section of the East Malling Research Station.

Disposal of Farm Waste Products

H. FISH gives the River Board point of view

New legislation is aimed at preventing the pollution of watercourses by farm effluent

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NOT much thought has been given in the past to the disposal of liquid farm wastes. Before the war there were no really significant quantities of farm wastes to be disposed of, and a considerable proportion of these were either returned to the land or stored in the old-style farm ponds. Over the last twenty years, the increasing productivity, centralization and water usage of our agriculture has markedly increased the volume of farm wastes to be disposed of. The majority of farmers nowadays try to pass the waste waters away from the farm premises as quickly as possible, usually via settlement pits or tanks, to the nearest ditch or stream.

There is nothing theoretically wrong in the notion that farm waste waters should be disposed of by purification followed by discharge to streams. Unfortunately, it is a practical fact that farm wastes cannot be purified adequately by conventional means, and usually the discharges to streams cause pollution in varying degrees. Yet there can be no doubt at all that the agricultural industry, with its increasing demands for water, which can only be met by taking more from streams, either direct by farmers or by the water supply authorities supplying the farms, has considerable interest in seeing that stream pollution is kept to a minimum.

River Boards, as the pollution prevention authorities, have the duty of ensuring that the use of streams for waste water disposal is controlled so that other stream uses are not adversely affected. And it can be taken as a practical fact that when the water supply uses of streams are safeguarded, almost all other stream uses, including fisheries, are adequately protected.

Pollution from farms

Of course, the major pollution problems facing River Boards generally arise from the disposal of sewage and trade effluents in the larger conurbations. However, in the predominantly agricultural areas, particularly in south-eastern England, where agriculture is intensive and where the rivers and streams are small yet have to meet relatively very large water demands, too much pollution is being caused by farm drainages. This situation can be substantiated by the following facts relating to the position in Essex. Here, three small rivers serve as the source of water supply for about 1¼ million people, with associated industry and agriculture. The last time that a water-works intake on one of these rivers had to be shut down because the river water was polluted, the pollution originated from farm drainage. Further, during the last three years, farm drainages have caused at least as many general pollution difficulties as discharges of any other waste waters.

It is not intended here to deal with the subject of the prevention of pollution arising from the use of toxic chemicals in agriculture, important though this is, for the only problem arising is that of persuading the users to handle and apply these chemicals and dispose of waste containers without causing contamination of stream waters. Much more difficult problems arise in finding economical and effective methods of disposing of the drainage from farm buildings.

The polluting effect of farm drainage derives mainly from its content of organic matter, present partly as settleable solids and the remainder in solution or fine suspension. When this drainage is passed to streams, the micro-organisms of the decay break down the organic matter, eventually to inorganic or mineral matter, using in the process the oxygen dissolved in stream waters. If the concentration of organic matter in the drainage discharged is sufficiently high in relation to the clean water dilution afforded by the receiving stream, all the oxygen dissolved in the stream will be used up and the stream water will become offensive. Any fish present in the stream, being dependent on a reasonable concentration of dissolved oxygen in the water for their respiration, would be destroyed long before the stream water was made offensive. To illustrate in practical terms the polluting effect of farm waste, it can be said that one gallon of typical grass-silage drainage may require complete mixing with 20,000 gallons or more of clean stream water

before the mixture could be considered unpolluted. Cowshed and piggery drainages would require perhaps one-twentieth of this dilution.

It may be thought that if farm drainage is passed to a ditch which normally dries out before it reaches any stream of consequence, no pollution troubles could arise. This is not always the case, and seldom so when silage drainage is involved. Summer storms frequently wash out accumulations of farm drainage from ditches into streams to kill fish and cause other pollution troubles.

Legal position

It is necessary to mention the legal position in respect of stream pollution. The Rivers (Prevention of Pollution) Act, 1951, prescribes that it is an offence to discharge polluting matter into a stream. The same Act also prescribes that it is an offence to bring into use a new outlet and to make a new discharge of sewage or trade effluent to a stream without the consent of the River Board. A River Board may refuse consent, or grant consent subject to conditions. The Rivers (Prevention of Pollution) Act, 1961, prescribes that within a period of time not yet specified, which will not be less than twelve months after 27th September, 1961, the persons responsible for the making of discharges of sewage or trade effluent to streams, which discharges were being made before the 1951 Act came into force, must seek the consent of the appropriate River Board for continuation of the making of the discharge. In granting consent, a River Board may lay down conditions. In both these statutes, farm drainage, save that of sewage effluent from farm dwellings, is defined as trade effluent. Also the definition of a stream includes any watercourse, not being a lake or pond with no outlet to a stream, even those watercourses which are dry for considerable periods. Consequently it is likely that nearly all discharges of farm drainage are subject to River Board consent. After the expiry of the period within which application for consent should be made (yet to be specified under the 1961 Act), only those discharges of farm drainage to streams for which consent of the River Board has been obtained or is being sought will be legal.

There are two other legal points of significance. Firstly, the killing of fish by pollution is an offence against the Salmon and Freshwater Fisheries Act, 1923. Secondly, the common law aspect of pollution, whereby a riparian owner has the right to insist that the stream water passing through his land should be unpolluted, has to be borne in mind. Persons responsible for discharges to streams may take some consolation from the fact that if they meet the requirements of River Boards, common law difficulties are often avoided.

Dealing with farm drainage

On the question of how farm drainages should be dealt with, there is unfortunately no simple universal answer. Cowshed and piggery drainage, together with the dairy drainage, silage drainage and the effluent from the domestic septic tank may be disposed of successfully by organic irrigation. This method has the obvious advantage of reclaiming the manurial value of the wastes.

If an irrigation reservoir of half a million gallons capacity or more is available, cowshed and piggery drainage after settlement in a tank, together with dairy drainage and the effluent from the domestic septic tank, may be

pumped or gravitated to the reservoir. Provided the waste-water inlet to the reservoir is sited as far away from the reservoir overflow as possible, any water overflowing to a stream from the reservoir should be quite unpolluting. A larger reservoir should be capable of dealing also with silage drainage. Again, this method has the advantage of returning to the land most of the manurial value of the farm drainages.

If neither organic irrigation or reservoir storage can be provided, silage drainage should be dealt with by collection in an underground watertight storage tank. From there it may be carted away at intervals and spread thinly on grassland or on any bare ground available. The possibility of disposing of silage liquor by soakaway into the ground needs careful consideration in each case, for underground water supplies may be polluted. Silage drainage is so very strong that it is quite impracticable to attempt to purify it, and no River Board would agree to silage drainage being passed to a stream. Cowshed and piggery drainages, kept free of roof-water and other clean water run-off, could be dealt with by settlement, followed by land disposal in underground field pipes. Dairy cooling water could be passed direct to a stream, while dairy wash-waters and domestic sewage may be passed to a septic tank, followed by soakaway in field pipes, or treatment on a filter provided with adequate under-ventilation, before discharge to the farm pond.

If the sewer of a local authority's main drainage system passes close to the farm premises, connection of the domestic sewage to the sewer can be made by arrangement with the local authority. In the Public Health Act, 1961, farm drainage is for the first time recognized as trade effluent so far as connections to sewers are involved. Consequently these wastes may, if the local authority approves, be discharged to a sewer. Unfortunately, silage drainage is so powerful a liquor that few local authorities could accept it into their sewers.

Ask the River Board

Whenever questions arise as to how farm drainage should be disposed of, careful consideration should be given to local circumstances, including the availability of public sewers, the nature and lie of the farm site, and the character, flow and downstream uses of nearby streams. River Boards are willing to assist in all these matters; their officers are available to give advice and guidance to all farmers with waste disposal problems. Indeed they carry out their responsibilities on the basis that their co-operation with all persons making discharges to streams is the only realistic and effective method of controlling pollution to achieve the aims of the Pollution Prevention Acts, namely, the restoration and maintenance of the wholesomeness of stream waters.

Mr. H. Fish, B.Sc., A.R.I.C., is Pollution and Fisheries Inspector of the Essex River Board.

The Single-Suckler Beef Herd

Full use of grass, low labour costs and a good stocking of cows to the acre are three points from this article by

A. W. Prowel

TRADITIONALLY the single-suckler system is associated with our hill and upland areas. Calves are reared under 'natural' conditions and are quick-growing, strong and healthy. Herds are in the main bred pure. In the upland rearing areas of Wales, full advantage has been taken of the Premium Bull Scheme on the small farms. This has greatly accelerated herd improvement and development. The quality and uniformity of stock appearing in the markets bears striking testimony to this.

The commercial herd, as opposed to the specialist pedigree herd, is rarely the main enterprise, but is usually part of a mixed farming system. In the livestock-rearing areas cattle are extensively, rather than intensively, managed, and are complementary to sheep. Sheep are more efficient converters of the resources of the land, and the relationship in numbers between the two classes of livestock is so arranged as to give priority to sheep. The ratio of sheep to cattle varies with the quality of the land and situation of the farm. There is a range of from 12 ewes and above to one breeding cow in the uplands, to 4 ewes to the breeding cow on the better land at lower altitude.

Subsidies make a difference

The single-suckler system is one of low output and, to be economic, it has to operate on a low labour/low cost basis. During the last few years, single-suckler herds have been established on many lowland farms in England and Wales. Though comparing unfavourably in output with other enterprises, simplicity, particularly as regards labour, has been attractive on arable and mixed farms.

Tillage has always occupied an important place on the farmlands of the Welsh Border country; soil type and climate are well suited to it. As in other parts of the country, corn, roots, cattle and sheep seem to come together and emerge as livestock rearing. Bulky, home-grown fodders make it possible to overwinter breeding stock and the year's calf crop. But in the poorer and wetter uplands the problem is to conserve sufficient winter fodder.

Formerly there appeared to be little solution to this problem, since young cattle from single-suckler herds would leave little if any profit margin if sold at less than 15 months of age. With the introduction of calf subsidy, and more

important still—cow subsidy, the picture has altered. These subsidies now make it possible to sell off young stock in the autumn, and their place can be taken by more breeding cows.

Selling weaned calves

The now well-established suckler calf sales in Brecon and Radnor cater for the disposal of strong, well-grown, healthy, weaned calves. A keen demand exists for young animals of 4½ cwt and over; small, late spring-born calves are in little demand. This has stimulated a policy of earlier spring calving in an effort to sell most of the calves off the farm in the autumn.

Uniformity of the product offered and a high standard of sales organization are features of the bigger autumn sales centres. In Brecon and Radnor the calves on offer for sale are predominantly Herefords. They are strong, healthy and sold in lots well matched for size and age. All are dehorned, the operation usually being done within one month of birth. Bull calves are castrated any time up to six months of age. In preparation for the day when they will arrive on buyers' farms most of the calves will have become accustomed to dry feeding.

Weaned calves sold in the autumn have made on average over the last few years about £8 10*s*. per live cwt. Heifer calves sell at from 25*s*. to 30*s*. per cwt less than steers. Autumn-born calves at 5½–6 live cwt sell on average at £48 or so, and spring-born calves of 4½ cwt at about £36.

Herd management

In well-managed herds, calving takes place at one or two well-defined periods of the year—winter or spring. This is vitally important to ensure that uniform age groups of cattle will be available for marketing. It simplifies management, and the herd can be treated as a unit rather than in separate groups of cows with calves of different ages.

Spring calving takes place mainly during March and April. On the more sheltered farms, at lower altitude, many herds calve out of doors, and since grass contributes little at this period of the year, the cows are still getting winter fodder. Good growth is made and the young animals are usually sufficiently well grown and strong to cope with the flush of milk which coincides with the May and June grass.

Weather conditions are still harsh in the uplands in early spring, and cattle are not usually out to grass until April, or even early May. Here, calving is later and many of the calves are born indoors. Late-born calves often have difficulty in coping with the amount of milk which the cows have in May and June, and digestive scour can be a problem. To overcome this, cows are often brought in to be sucked and 'stripped', and at this period the calves are kept indoors.

Where the climate is kinder and food supplies are ample, an increasing number of herds are planned to calve in winter. But even on these farms there will still be a number of spring-born calves.

A bull running with the herd is a feature of the system on the larger farms. Withdrawing the bull from the herd at the right period of the year may mean that the odd cow misses service at that time, but such a sacrifice is often accepted in the interest of a well-defined calving season.

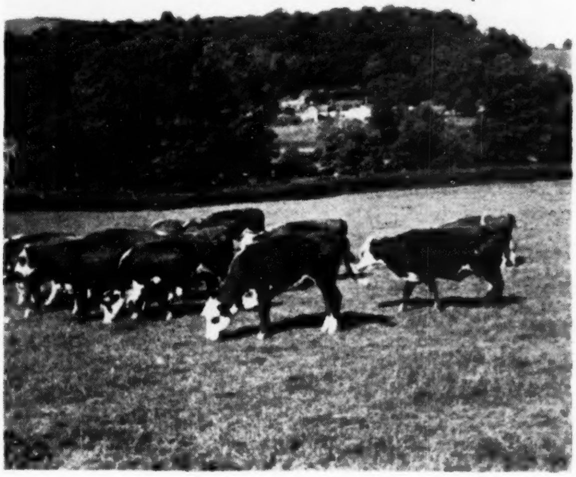
Straw, home-grown cereals, and some roots or silage, are the main items of food. The quantities of these foods fed during the winter differ from farm to farm; the quantity of feed given is dependent on the stockman and, most important of all, the length of the winter feeding period. On many farms it is held to be sound practice for cows to lose much of the fat which they have acquired at grass during the summer, and the level of feeding practised is aimed at maintaining 'store' condition. The spring calf at birth is able to cope with the milk supply available to it; and later, as this increases, the calf also is sufficiently well-grown to cope. The treatment of winter calves is more liberal.

Weaned calves kept and overwintered

Many calves are overwintered and are sold in the spring or the following autumn as stores. Winter food consists in the main of hay, roots and cereals. Cost including feed, labour and miscellaneous items can vary from £13 to £16 per head. Some records taken over the years show that spring-born calves which have been retained enter the winter in November at about 440 lb live weight on average. The general order of liveweight gain throughout the winter period is within a range of approximately $\frac{1}{2}$ lb to $\frac{2}{3}$ lb per day.

It could be considered desirable for these animals to be putting on at least an extra 1 lb per day. This is a debatable point. For animals of this age and size is the additional cost of feed necessary to attain this weight gain justified? Remember that when sold these animals will attract only store price. To achieve the extra live cwt during the winter, could mean an extra £6 10*s*. to £7 spent on concentrates. It would appear to be more sound financially to rely on the contribution which grass (the cheapest food) can make during the following spring and summer, when daily liveweight gains of from $1\frac{1}{2}$ lb to over 2 lb are possible.

There is usually a keen demand in the spring for forward stores, and with calves entering the winter at about $5\frac{1}{2}$ cwt, it is economically sound to get a daily liveweight gain of $1\frac{1}{2}$–2 lb. At 7 cwt, and at a selling price of about £60, there is a fair margin of profit. Also, being disposed of in the spring means that grass is available for other livestock.



15-months-old cattle at summer grass—improving, but still showing signs of lean winter condition

SOME FIGURES FOR COSTS OF PRODUCTION AND PERFORMANCE

(average from a number of case studies)

	Winter calving herds (Nov., Dec. and Jan.)		Spring calving herds (Feb., March and April)	
Winter food costs per cow	3 cwt oat sheaves 10 cwt roots 23 cwt hay 1 cwt purchased concentrates 8 cwt litter	£15 12*s.*	11½ cwt oat straw 12 cwt hay 5½ cwt roots 5½ cwt oat sheaves ½ cwt purchased concentrates 5 cwt litter	£13 10*s.*
Winter food costs per calf	3 cwt hay 2¼ cwt rearing cake	£4 5*s.*		nil
Grazing costs (cow and calf)		£6		£6
Creep feed (in autumn for calf)	½ cwt cereal mixture	12*s.*	30 lb cereal mixture	7*s.*
Miscellaneous costs (including depreciation)		£5 10*s.*		£5
Labour estimated		£5		£4 10*s.*
Total costs		£36 19*s.*		£29 7*s.*

Returns (excluding calf and cow subsidies)

1. *Selling weaned calves*

From winter calving herds		*From spring calving herds*	
Average live weight per calf (average of male and female calves) 5¾ cwt @ £8 10*s.* (average sale price per live cwt over 3 years period)	£48 17*s.* 6*d.*	Average live weight per calf (average of male and female calves) 4¼ cwt @ £8 10*s.* (average sale price per live cwt over 3 years period)	£36 2*s.* 6*d.*
Margin per cow:	£11 18*s.* 6*d.*		£6 15*s.* 6*d.*

2. *Selling stores*

Overwintering (late spring-born) weaned calves for sale as stores in the following autumn

Winter feeding costs per calf (140 days) 15 cwt hay 2½ cwt kibbled oats 8 cwt swedes	£11 8*s.*	Average live weight of calf at beginning of winter period 440 lb
Labour estimated	£1 15*s.*	Live weight at end of winter period 537 lb

continued opposite

Miscellaneous (including litter, etc.)

	£1	i.e., gain of 97 lb live weight = 0·7 lb live-weight gain per day
Total winter cost:	£14 3*s*.	

Summer grazing costs (172 *days*)

Approximately	£2 15*s*.	843 lb live weight at the end of September i.e., a summer gain at grass of 306 lb = 1·8 lb liveweight gain per day
Total cost from weaning to sale in the following autumn at 17 to 18 months of age	£16 18*s*.	
Total costs from birth to 17 to 18 months (including costs of cow, etc.)	£46 5*s*.	Estimated value of beasts at 17 to 18 months £55 to £60

*All home-grown foods at production costs.

The above takes no account of calf and cow subsidy benefits, and the figures given throughout are averages. There are many farms, particularly amongst the spring calving herds, where feed costs are somewhat lower than those given. Again, where it is possible to bring forward the calving period to February, an extra $\frac{3}{4}$ cwt live weight is possible by autumn. At £8 10*s*. per cwt this represents an additional price received of £6 7*s*. 6*d*., without necessarily incurring any extra cost.

Feeding costs can be reduced

Cereals and root crops figure prominently in the economy of the rearing farm, and machinery costs particularly can be attributable directly to growing and harvesting crops for cattle. The most obvious advice would be for an all-grass policy, making silage and buying cereals and some hay. But the position universally is not so easily solved. The size of ewe flock carried on a number of farms is closely linked with the root crop, the cost of growing which has decreased markedly over the last few years with the widespread use of the precision-drilling technique. Incorporating a cereal crop as part of the rotation for roots would, under these circumstances, not appear to be uneconomical. There is a close inter-relationship of sheep and cattle on such farms, and from the data available it is not at all clear whether adopting an all-grass policy would at present be the most suitable thing to do.

Nevertheless, on so many farms, grass—the cheapest of the home-grown foods—makes the greatest contribution to livestock production. It is not surprising, therefore, that silage for winter feeding is slowly gaining in popularity, and reductions in food costs of the magnitude of 30 per cent or more have been achieved.

Loose housing, restricted and *ad lib.* silage feeding systems which have developed are not, however, without certain attendant problems—such as slurry and the extra cost of additional litter required. Also spring calving herds tend to give more milk than is the case with the traditional system, and this can be both tedious and troublesome.

There is a lot of to-and-fro cattle movement under loose housing conditions, and a certain amount of pushing and buffeting is inevitable. Muck and wet,

spongy litter add to the difficulties of the newly-born calf before it is strong enough to be able to move about and seek shelter in the calf escape area. This, amongst other reasons, is why October calving outdoors is being aimed at, so that when housed later on, the calves are strong and better able to fend for themselves.

In spite of these problems, however, feeding costs tend to be reduced and at the same time extra cows can be kept, and it does seem that good grassland and full utilization of grass is one of the corner-stones of the continued prosperity of single suckling. There is still scope for home-produced beef to compete with other forms of meat at the right price. The single-suckler system operating on a low feed/low labour cost basis, and where the density of cows kept to the acreage of the farm is increased, can offer opportunity where the technical skill and business acumen of the farmer are exercised to the full.

Mr. A. W. Prowel, N.D.A., who is County Advisory Officer for Brecon, has had a wide experience of cattle and sheep husbandry and is a frequent contributor to a number of farming journals.

Manure Disposal in German Cowhouses

Robert J. Forsyth **J. Walker-Love**

A development of the slatted floor principle is being used successfully for manure disposal in German cowhouses. Certain features of the system could also be used for the removal of slurry from loose housing

CLEANING out the cowshed has never been a popular job. There is a continued need to reappraise all the traditional ways of doing things to keep costs within proportion and make agricultural work just that bit more congenial. One has also to reckon with the Rivers (Prevention of Pollution) Act, 1961, and, henceforth, its stricter enforcement.

Some, of course, have gone over to loose housing. However, even with this system there is often the problem of slurry and its disposal.

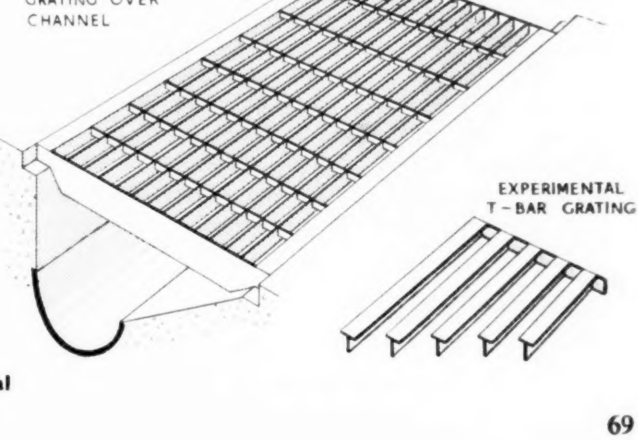
There seem to be two distinct problems to be faced: simplification of cleaning the traditional cowshed, and disposal of liquid manure or slurry, whether it comes from the cowshed or elsewhere.

Conscious of these problems in dairy farming, we recently visited Western Germany to study, in particular, the Hölz method of manure disposal which is gaining popularity in that country with surprising speed. This is primarily designed for the cowshed, but certain features could be incorporated for the disposal of slurry from slatted floor housing. After three years in use, the system is proving itself to be practicable and applicable under a wide range of conditions in Western Germany: over 600 installations are surely fitting testimony to this.

The reasons for its popularity are fairly apparent. Since valuable agricultural land has been lost to East Germany, there is now an urgent need to make farms in the West more productive; thus more stock is carried and more crops are grown. Secondly, in Germany as in Britain, there has been a drift of labour from the land to the factories, and so the main burden of the farm work falls more and more on the farmer and his family. With increased production, farmers are forced to seek ways of easing this burden, and the Hölz system offers at least a partial solution to the problem.

One further point—Germany, particularly in the south, is still without fences, and cropping is carried out in long strips. Due to this and the scarcity of stockmen, some farmers are obliged to zero-graze fodder, keeping the stock tied up indoors.

Briefly, the Hölz system consists of a deep manure channel covered with a grating, immediately behind the cow standings, which is normally made of iron or steel but can be of reinforced concrete. Liquid and solid manure is collected and held in this channel for not longer than four days. To empty the channel, a simple hand-operated sluice gate at its lower end is lifted to allow the sludge to flow into a mixer/pump chamber immediately outside the building. From this chamber the sludge may be pumped directly into a distributor cart, or into an adjacent agitator/storage tank, from which it is later conveyed to the fields for distribution either by suck-lift manure cart or by portable organic-irrigation pipeline.



Byre Manure Disposal

Pumping chamber and storage tank

The mixer/pump chamber houses a submerged pump powered by a 3-phase electric motor immediately above it. Incorporated in the pump unit are simple rotary, pulverizing blades to obviate blockages.

The size of the storage tank is based upon a capacity allowance of 7·86 cu. yards per cow housed over a 90-day period. The floor is laid to fall diagonally at approximately 1 in 100 towards the pump chamber so that, when required, the sludge will gravitate into this chamber for pumping into the distributor cart. To ensure that the solids are kept in suspension, mechanical paddle agitators are mounted on a horizontal shaft inside the storage tank. A shaft approximately 50 feet long may be driven by a single motor mounted above one end of the tank. When a longer shaft is required it becomes necessary to provide a motor at each end of it.

Method of tying

On all farms visited, the cows seen housed were of the Black Pied Lowland breed, which appeared to be slightly smaller than the British Friesian. They were stalled in double rows facing inwards towards a central feed passage, which was normally about 7 feet wide. In some instances it was even wider, but without apparent advantage.

The animals are secured by special yoke-ties designed to ensure that, when the animals are standing, the dung will be dropped directly on to the grating. The length of the stall from the trough to the grating, for milk cows, was found to vary between farms from 4 ft 11 inches to 5 ft 2 inches, and in some instances this dimension was gradually reduced throughout the length of a range of stalls to a minimum of 3 ft 9 inches to accommodate young stock and calves. The effective length of stall is critical in keeping the cows clean, and is influenced by the type of yoke employed and by the exact position of the floor ring to which the yoke is fastened. Two types of yoke were seen in use during the tour—a tubular metal type recommended for milk cows and a 'Dutch tie' chain type for young stock. Water bowls were fixed to the tubular framework of the yoke-tie, immediately over continuous troughing.

It is claimed that no bedding is required, but it was emphasized that the lying area should be of insulated construction. Straw should not be used, but there seems to be no objection to sawdust as bedding material. Under these conditions the cows' feet should stay drier and harder than when they are subjected to softer and wetter conditions, as in courts or in byres where the animals are standing back in the grip.

The animals did not seem to resent standing on the grating, and indeed it was claimed that in many instances they chose to walk along the grating rather than on the walk when entering or leaving the byre. Nevertheless precautions had been taken at times to guard against possible injury, for which purpose smooth round-edged plastic guards which clip over the individual bars of the grating were used. Such guards were required only if the grating was made of metal.

Details of installation

The type of grating normally supplied for the system is made up in readily removable panels, 3 ft 4 inches long by 2 ft 6 inches wide, and it is of utmost

importance that no step, or even minor change in level, should exist between the lying area and the top of the grating, since this could cause discomfort to the cow.

The side of the channel nearest to the cow should be almost vertical, whereas the opposite side should slope at 30–45 deg., depending on the depth of the channel. The depth of the invert of the channel under the grating was found to be 15½ inches below the finished floor level at the higher end. The bottom of the channel consists of 10-inch diameter, half-round, salt-glazed drain pipes. Although these pipes are laid to a fall of not less than 1 in 100 and not more than 1 in 50, a fall of 1 in 66 is considered the most suitable. This below-floor-level drainage system enables the floor of the byre to be laid level throughout its length—a point of interest when building on a level site.

In operating this system, it is necessary to add some water, initially, to the channel. This counteracts moisture losses resulting from evaporation and maintains a suitable consistency of the contents of the channel for flowing and, later, for pumping. For this purpose, a minimum depth of 4 inches at the higher end is recommended. To prevent an excessive depth of water at the lower end of a long channel, light elm-framed sluice gates are inserted at intervals of 65 feet, dividing the channel into convenient lengths. A thin cast-iron drop-plate, with a hand-hole on its upper edge, slides vertically in grooves formed in the two side rails of the frame. In addition, rubber strips are inserted into angled slits formed in the pressure side of the frame to seal it tightly against the steel plate. No such precaution is considered necessary along the lower edge, which is said to be sealed automatically by silt accumulating at this depth.

Experiment and observation

Members of the Max Planck Institute for Agricultural Work, Science and Engineering at Bad Kreuznach are experimenting with other forms of grating—metal and concrete—in an attempt to find a more comfortable and safe surface upon which the animals may tread. Evidence to date tends to favour a panel consisting of metal T-bar sections, but the Institute is hopeful of finding a type of narrow-slatted concrete panel still more suitable for the purpose.

In a few cases, waste hay and straw were found to be hanging on the standard grating. With the narrow flat-bars on edge, such debris is liable to get caught up, and the careful brushing necessary to free these wisps can take time. With a broader surface, this material does not adhere to the slat so readily and, in any case, is more easily dislodged. Since the grating is not trodden so much as in a slatted court where the animals are free to move around, it does not always keep so clean. The more solid dung tends to remain on the surface of the grating and occasional brushing is necessary. This point is not regarded as an insurmountable difficulty, however, since it will be agreed that if the feeding is in accordance with good husbandry then the dung will be of a consistency to pass through the grating.

Advantages claimed

Advantages accruing from this system may be considered from three distinct aspects, animal cleanliness, labour savings and land fertility.

Work undertaken at the Max Planck Institute indicates that when the standard metal grating is used with the deep dung channel system, the cleanliness of the cows is similar to that of cows housed under the conventional byre system. The same work also shows however that, to date, the T-shaped angle-irons and concrete bars used experimentally as an alternative to the standard grating have resulted in a much higher measure of soiling.

Labour requirements and costs of handling manure in the conventional byre manure channel system and the deep channel system were also studied at the Max Planck Institute and are compared in the following tables.

Labour requirements in man-min/cow/day

Type	No. of cows	Byre mucking	Muck spreading	Total muck-handling
Conventional byre (mucking by barrow)	50	2·92	0·89	3·81
Byre with standard grating over dung channel	50	0·87	0·53	1·40
Byre with T-shaped angle-irons over channel	50	0·47	0·53	1·00

Cost of handling manure in £ s. d./cow/year

Type of byre	Number of cows 20	50
Conventional stall byre	£10 10*s*.	£8 10*s*.
Stall byre with slatted manure channel	£10 10*s*.	£8

This includes all fixed and variable costs of labour, power, depreciation, maintenance and interest on the relevant buildings and equipment. It does not, however, include the effect of manure in the fertility programme. Workers to date indicate that there is a definite advantage in increased fertility, but this is difficult to establish precisely for a number of reasons. It depends upon when the manure is applied and under what conditions, and upon the level of other manuring, type of sward and class of grazing stock.

However, to whatever extent it depends upon these factors, increased fertility and response from liquid manure seems to come in three ways:

1. More dry matter yield when urine and dung are put on together rather than separately.
2. With less clover in the sward, a greater response is obtained when additional inorganic nitrogen is applied.
3. Through a longer grazing season.

Fertility is intimately associated with time of application. Winter application was thought to dissipate much of the value of liquid manure, but recent work suggests that this is not such a real danger so long as the manure is not applied during hard frost when it can be surface-washed into ditches.

It is reasonable to think that the increased fertility for a 40-cow herd can be valued at £50 at least, and probably nearer £100—the value increases as more inorganic nitrogen is applied.

Disadvantages

The disappointing aspect of this system is undoubtedly its high cost. The approximate cost of the equipment in relation to herd size, as indicated to us during our study tour, is given as follows:

Size of herd	Cost per cow	Size of herd	Cost per cow
10 cows	£60	35 cows	£32
15 ,,	£47 10*s.*	40 ,,	£31 5*s.*
20 ,,	£42	45 ,,	£35
25 ,,	£39	50 ,,	£30
30 ,,	£36 15*s.*		

Note that the cost per cow gradually diminishes to a herd-size of 40 cows, after which it fluctuates, owing to the necessity of installing higher-capacity equipment.

Existing systems of mechanical cowshed-cleaning in Britain range in cost from approximately £1 per cow to within the region of £20 per cow. Of these, the shuttle-stroke scraper is perhaps the most popular, and this costs from £12 to £16 per cow.

These costs would seem to put the Hölz system at a considerable disadvantage. It should be remembered however that the Hölz system does take the manure disposal one stage further in conveniently linking up with a suck-lift distributor cart or organic irrigation system. It is also true that the full value of the liquid manure is saved for use. The question must therefore be asked, do these advantages close the gap in cost between this German system and these systems in current use in Britain?

Where a farm is already equipped or likely to be equipped for summer irrigation, then out-of-season manure disposal, to all intents, can be taken as free. The position on other farms is not so clear. The economics must rest on a saving in labour and any fertilizing advantage from the enhanced value of the manure obtained.

From observation it was quite obvious that, given the correct conditions with proper attention to detail, this system works satisfactorily and seems suitable for use in this country subject to a full investigation of costs here.

When the conversion and/or installation costs are added to the equipment cost for a 40-cow herd, the complete installation is likely to cost over £40 per cow. A portion of this cost can be justified by the attendant saving in production costs but, without doubt, part of the value of the system lies in making dairy work more attractive.

There was no smell other than that normally found in a dairy byre, so long as the channel was emptied every three to four days.

There appeared to be fewer flies than in the conventional dairy byre, and this may be due to the lesser quantity of manure exposed.

While none of the installations visited in Germany was linked to field irrigation, such a combination could well be a practical possibility, especially for the farmer with a valuable cash crop and an adequate water supply.

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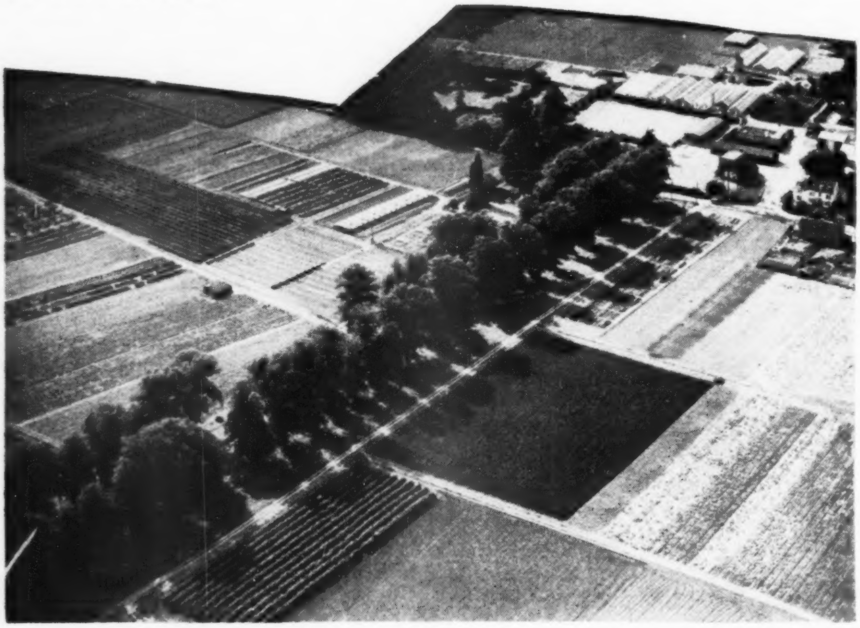
Teaching Farm Management

E. C. Cordell



Part of the Horticultural Department at Swanley

It is becoming increasingly apparent to all thinking farmers and growers that the ability simply to produce crops is not sufficient to get a reasonable living from the land. Maximum yields of good quality crops must be produced as economically as possible, and once grown must be disposed of at remunerative prices. To achieve these objectives it is necessary to make a detailed study of all the processes involved. It is therefore vital that those who are to hold key roles in the industry should have received adequate instruction in the principles and practices of crop production, and in the various aspects of management which are likely to influence the economics of such production.

The full-time horticultural courses at Swanley have been planned to meet this need. Initially, students complete a minimum of two years' practical work in the industry before undertaking a one-year's full-time general course. This course aims at giving them a reasonable knowledge of sound commercial practice and the underlying scientific principles. This is achieved by means of instruction in the lecture room, laboratory and on practical instruction units, where the students work under skilled supervision and undertake a wide range of horticultural operations. These practical instruction units are supplemented by management units where a limited number of crops are grown on a commercial scale under conditions as similar as possible to those in the industry.

At the end of the General Course those students who have reached a satisfactory standard are encouraged to undertake a one-year's Supplementary Course in one of the major branches of the industry, and the Kent Institute offers such courses in Glasshouse Culture, Fruit Culture and Nursery Practice. At this level the students begin to realize the importance of management, and the instruction is designed to place particular emphasis on this aspect.

From basic principles

Lectures are given on the basic principles of management, also showing how the subject is being applied in practice. Students are individually given the opportunity of putting the principles into practice for themselves. The basic principles taught include both Method Study and Work Measurement. In method study the object is to find better ways of undertaking jobs and of improving the layout of production units. This necessitates the selection of the job to be studied, the establishing of what is really going on and the accurate recording of the information so obtained, followed by a critical examination of this information to see where unnecessary activities can be eliminated and improvements made. It is a constructively critical approach to what are the really essential characteristics of a progressive horticultural industry, and this is constantly being emphasized to the students.

Work measurement forms another important aspect of the courses. Particular stress is placed on its value in connection with the adoption of incentive schemes. It is interesting to note that such schemes are being increasingly used by the industry to encourage workers to achieve higher standards of work and greater productivity, for which employers can afford to offer higher rates of pay. Many growers, especially those with a relatively small acreage, are using more and more part-time labour to carry out major operations such as planting and harvesting of crops, and the ability to carry out production studies and to evaluate new techniques enables the grower to employ such labour at the most advantageous rates both to himself and the worker.

To practical application

So that students should fully understand the practical application of the various aspects of management, a recent development has been to establish 'smallholdings', in addition to the existing management units. Each 'smallholding' is the responsibility of a single student throughout the duration of the course; though they are run on co-operative lines with each student being encouraged to co-operate with his neighbours. A complete set of records is kept starting with a description, scale plan and ingoing valuation of the holding, and finishing with a profit-and-loss account and balance sheet. This enterprise provides an excellent basis for management studies, and the importance of such items as detailed planning, budgeting and budgeting control, and labour organization can be imparted realistically. Work on the management units is considered in detail and decisions reached as a result of these considerations are carried out as quickly as is practicable. The result is a marked increase in efficiency on these units, with consequent advantages to all concerned. Throughout all the instruction the necessity of maintaining good labour relationships is stressed, and by the end of the course the

importance of the human factor is usually thoroughly appreciated by the students, who have suffered from being 'employed' by each other from time to time.

The horticultural industry today is beset by a number of serious economic problems, not the least of which is that of ever-increasing competition at home and from abroad. To face up to these problems and overcome them, it is essential that the industry should be able to obtain really well-trained persons who are not only well grounded in the principles underlying sound commercial practice but who also have the ability and knowledge to enable them to apply these principles in practice.

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Farm Management

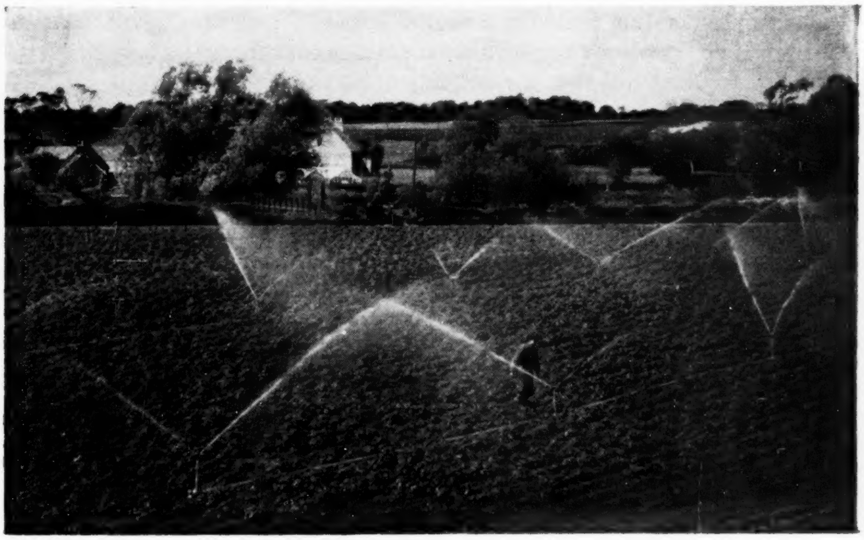
Irrigating Potatoes

Is the irrigation of potatoes worth while?
What will it cost and what will be the likely return?
These questions are answered by

J. J. NORTH

As with all other crops grown for direct sale, high yield per acre is the most important factor in obtaining satisfactory gross margins from potato growing. Consumer demand tends to remain fairly constant year by year, and as a result any fluctuation in supply is reflected in a marked change in the grower's price. In a year when yields are low growers' prices may be twice those obtained in a year when supplies are plentiful, even with the operation of the support-price guarantee. Thus any grower who is able to keep up yields in years of high prices will gain considerable financial advantages.

Such yield variations are due solely to seasonal factors, the most important being the amounts of summer rainfall and more particularly its distribution during the growing season. In most years in many potato-growing areas summer rainfall is inadequate and its distribution unsatisfactory. There are, however, the odd years (e.g., 1958) when lack of sunshine and not shortage of rain is the controlling factor. But such years occur possibly only one in ten, whereas shortage of rain may be limiting crop yields eight or nine years in ten.



Aluminium pipe sprays in action

In these circumstances irrigation can be used to supplement rainfall and will undoubtedly go a long way towards keeping potato yields at a consistently high level. Even so, can irrigation be used economically on many farms? Two questions must obviously be answered: how much does it cost, and what are the likely returns?

Capital costs

Costs vary considerably from farm to farm, depending on individual circumstances, but many schemes are costing between £800 and £1,200 for a unit capable of irrigating 30–40 acres satisfactorily during any drought period. For the smaller farm, costs are proportionately higher; a scheme to irrigate 10–15 acres may cost £400 to £600. These figures do not include costs incurred in obtaining the water. The provision of water from a borehole, or more commonly from a farm reservoir, will require extra capital. Boreholes, on average, cost between £2 and £5 per foot of depth, and in most areas a licence is required before a new borehole is sunk or an existing one enlarged. Under suitable conditions, and assuming that the reservoir is built to a standard to qualify for the 40 per cent Government water supply grant, reservoirs have been constructed at a net cost to the farmer from about £250 to £500 per million gallons stored.

Total operating costs

From the viewpoint of budgeting, irrigation equipment should be regarded as a machine, and as such some of the 'fixed' as well as the 'variable' costs must be set against the irrigation enterprise. Costs may then either be allocated equally at a constant figure per acre for all irrigated crops or according to the relative use made of the irrigation equipment for each individual crop. The latter system is to be preferred. Under this fixed costs, mainly depreciation and interest on capital, will decrease per acre inch with increased use, whilst the variable costs will more or less remain constant.

The total operating costs for a capital investment of £1,000 and a system capacity of 40 acres with and without water costs are shown in Table 1. In the example, it is assumed that the net capital cost of water storage is £500 per million gallons stored.

TABLE 1

Cost per acre inch (*a*) *including water charge* (*b*) *without water charge*

Inches applied per year	2	3	4	5
Acre inches applied per year	80	120	160	200
	s.	*s.*	*s.*	*s.*
Annual capital charge*	34	22	17	14
Water charge*	30	30	30	30
Fuel costs	6	6	6	6
Repairs and miscellaneous	1	1	1	1
TOTAL (a)	71	59	54	51
(b)	41	29	24	21

*Based on 10-year depreciation and 6 per cent interest charge

Labour charges have not been included in this table, since only in exceptional circumstances will the introduction of irrigation call for more workers. Surveys have shown that, on average, it requires two man-hours to apply an acre inch, including daily attention, labour required for setting out at the beginning of the season, field-to-field moves and putting the equipment into store at the end of the season. This increased labour demand can normally be accommodated within the existing labour force, though it will usually increase overtime. If a lot of overtime is needed, this should be charged against irrigation. However, where the scale of enterprise is large it may be necessary to increase the amount of labour, machinery and buildings to harvest and store the greater yield of crops grown under irrigation. This is best considered by a further partial budget.

Returns

Returns depend on many factors, including the standard of farming, the farmer's ability to apply himself to the new technique, and the amount of attention given to irrigation. Haphazard operation may bring little or no returns and will be an additional unnecessary cost; water must be applied at the right time and in the correct amounts to give the maximum returns. Under properly controlled irrigation it is reasonable to expect an increase in yield of about 1½ tons per acre of early potatoes and 1½–2 tons of ware per acre from maincrop potatoes for each effective inch of irrigation water applied. Increase in yield is only part of the extra returns, as irrigation has beneficial effects on quality as well. With controlled watering, secondary growth can be kept to a minimum and, combined with other husbandry techniques, tuber size can be controlled. Irrigated potatoes have a higher dry matter content, better storage qualities, and the incidence of common scab is greatly reduced.

Worthwhileness

The worthwhileness of irrigation depends on the average acre inches required per year. Because of the wide variations from year to year, this average can be obtained only by considering a period of years. Under controlled irrigation the number of inches applied depends on two factors, the location of the farm and the soil types concerned.

The amount of water required and used by the crop is controlled by the weather, being independent of crop and soil type. The major factor in controlling water use is the amount of sunshine and, since sunshine hours vary widely from place to place, so will the amounts of water used for transpiration. This water is supplied by rainfall and irrigation, the amount of irrigation necessary being directly dependent on the amounts of rainfall received in relation to the water used. Generally speaking, the amount of rainfall tends to increase and the water used decrease as one gets towards the north and west.

The soil type is important, as the amount of water which a plant can obtain from the soil for growth during dry spells is related mainly to soil texture. Potatoes are largely grown on the lighter-textured soils and, being shallow-rooted, need irrigation during the responsive growth periods when $\frac{3}{4}$ inch has been used from very light soils and $1\frac{1}{4}$ inches from medium-textured soils. This means that during dry weather in late June or July irrigation is necessary every six to seven days on light soils and every eight to ten days on the medium ones.

By taking into consideration these two factors, it is possible to prepare a budget and estimate the gross margins from using irrigation. An example for maincrop potatoes is given in Table 2 for farms in the 25-inch rainfall areas of Worcestershire and the $22\frac{1}{2}$-inch rainfall areas of Essex. It is assumed that the capital costs involved are those given for Table 1, including the water charge. The soil, light and medium, represents the soil types discussed above, the 'heavy' would be typical of the heaviest soils on which potatoes are likely to be grown, or for soils containing a high proportion of silt.

TABLE 2

Maincrop potatoes

Location	Soil type	Use of Ir. years in 10	Total in. per acre per 10 yr	Av. in. per acre per year	Av. increase yield* ton/acre/yr	Extra returns per acre £ s.	Ir. costs per acre £ s.	Gross margin per acre £ s.
Worcs	Light	9	23·25	2·3	3·45	46 14	7 17	38 17
	Medium	9	18·76	1·9	2·85	38 10	6 16	31 14
	Heavy	8	14·68	1·5	2·25	30 9	6 3	24 6
Essex	Light	9	28·65	2·9	4·35	58 18	8 14	50 4
	Medium	9	24·56	2·5	3·75	50 14	8 0	42 14
	Heavy	9	19·65	2·0	3·00	40 10	7 2	33 8

* assuming $1\frac{1}{2}$ ton/acre increase per inch applied

The returns are based on a market price of £13 10*s*. per ton, and no allowance for improved quality has been made. A similar budget can be made for early potatoes. For example, the data for areas of Kent with a 25-inch rainfall and parts of Cheshire with a 30-inch rainfall are set out in Table 3 overleaf.

Returns are not given, because of the large variations in prices received for early potatoes, depending on time of marketing. Irrigation encourages earlier tuber set and a quicker rate of bulking, so even quite small increases in yield will justify considerable capital investment since the financial returns can be large. Similar calculations can be made for all areas.

TABLE 3

Early potatoes

Location	Soil type	Use of ir. years in 10	Total in. per acre per 10 yr	Av. in. per acre per year	Av. increase yield ton/acre/year	Ir. costs per acre £ s.
Cheshire	Light	7	9·53	1·0	1·60	5 5
	Medium	6	6·23	0·6	0·90	7 8
Kent	Light	9	17·47	1·7	2·55	6 11
	Medium	9	12·97	1·3	1·95	5 16

Irrigation technique

As far as our present knowledge goes, early potatoes should be irrigated as soon as all the plants have fully emerged through the soil and whenever half of the available water has been used from the soil—$\frac{3}{4}$ to $1\frac{1}{4}$ inch, depending on soil type. Maincrop potatoes should not be irrigated until the tuber swelling stage has been reached, and again whenever half the available water has been used from the soil. At this stage the tubers are about marble size, and this coincides with early blossoming for flowering varieties, usually around mid-June. In very dry seasons and with varieties producing a small number of tubers (e.g., Majestic) one, or exceptionally two, irrigations before this stage is reached may be beneficial.

Mr. J. J. North, B.Sc., M.S., Dip.Agric., is the Crop Husbandry Officer in the West Midland Region of the N.A.A.S. For a number of years he has made a special study of irrigation problems as affecting crops such as potatoes, sugar beet and grass.

FOWL PEST POLICY has been under review by the Committee appointed under the Chairmanship of Sir Arnold Plant. In their Report (H.M.S.O. 7*s.*) the Committee feel that high costs resulting from the slaughter policy can be justified only when there is a reasonable prospect of eradicating the disease. They conclude that there is now no more than a remote possibility of this in Britain, that the immediate aim should rather be control, and that the present policy is not the most suitable form of control for the future.

Long-term, the Committee recognize that it might well be best to rely exclusively upon vaccines. For the immediate future, however, they recommend that (*a*) the cost of controlling fowl pest should be transferred to the poultry industry; (*b*) the use of slaughter to reduce the risk of spread of infection should be combined with the voluntary use of dead vaccines, and (*c*) the cost of compensation for slaughtered birds should be met from a levy on production of day-old chicks, turkey poults, ducklings and game chicks.

Repairs and Tenancy Agreements

J. F. Hoare

Have you a tenancy agreement? If not, see your landlord, valuer or solicitor, and make sure you are fulfilling your side of the bargain

HAVE you looked at your tenancy agreement lately? Do you know what all the clauses in it really mean? Perhaps you don't even have one; taking over the farm years ago was such a friendly affair, so there didn't seem much point in putting all the terms in writing. But will it all be as friendly when you leave and you are faced with a hefty dilapidation claim? Maybe there will be a new landlord by then who may not be so friendly.

The length of collapsed garden wall, the slates that have slipped over the loose box (the battens have become rotten with the rain now), the length of pipe that fell off, the rotten section of floor in the granary. Who is supposed to repair them? How often has the farmhouse to be decorated or the buildings painted? What of the gappy quickthorn hedge and the dead length of hedge which caught fire when the hedge trimmings were burnt?

If you have a written agreement properly drawn up, all these items will probably be covered by a series of clauses, so that both you and your landlord know exactly where responsibility lies. But even if there is no written agreement, you are still liable for quite a lot of work, and the Agriculture (Maintenance, Repair and Insurance of Fixed Equipment) Regulations, 1948, define the liability of landlord and tenant. So whether or not you have a written agreement, failure to maintain the buildings properly can result in a big claim being made against you when you leave.

But you are not going to leave the farm you say. Maybe not, but accidents do happen, or maybe there is a son who you hope will take over one day, and a landlord may not look kindly at a family which persistently neglects his property. Indeed this trouble may not wait until there is a change of tenancy, for at any time you may be served with a formal notice requiring you to remedy and put in order a hundred and one items of repair which you may not have realized it was your job to carry out. Worse still, failure to carry them out in a reasonable time could result in a successful notice to quit being served.

Many disputes (and ill-feeling) are often caused both during and at the end of the tenancy because there was no written tenancy agreement between landlord and tenant. It is all so unnecessary, for Scheme 5 of the 1948 Act makes provision for either the landlord (or the tenant) to require that all the terms of the tenancy are properly defined in a written agreement.

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Apples in Bins


Closely stacked bins

W. H. Smith

F. A. Roach

MORE attention is being given to storing apples in bins. This is the logical sequel to the original New Zealand practice, in which bulk bins were used mainly to carry the apples from the orchard to the packhouse for grading in the normal manner.

The types of bin originally used for bringing fruit in from the orchards and holding it temporarily before marketing have not always been the most suitable for use in cold store, where consideration has to be given to questions of ventilation. The dimensions of the bulk bin and of the store itself must be related.

It is a standard practice in Britain, where stores are generally designed with vertical air circulation, to stack boxes or trays of apples as tightly as possible. Cooling of the fruit depends upon contact with the cold circulating air; and air, when subject to pressure differences, will travel along the line of least resistance. It is therefore essential to see that no easy path is provided by wide gaps between the boxes themselves or between boxes and the walls of the store. Allowing a small margin for variation in stacking, bins, too, will need to be designed to fit the store without any waste of space.

The grower planning a new store in which he proposes to use bulk handling methods must first decide upon the size of the bin he will use and then the dimensions of the store. The mechanical loading of stores is facilitated if the cooling unit is placed on one of the walls and if the floor area occupied by it fits in with the dimensions of the bin. For example, it is often possible for the unit to occupy a floor area equivalent to that taken up by one bin. The British Standard pallet 40 inches × 48 inches, which is accepted internationally, has decided advantages for growers supplying co-operatives concerned with bulk handling and for growers who may do so later on.

Where there is already an existing store, a size and shape most convenient to fit the store must be chosen. Bins should be as nearly square as possible, with the longest side not exceeding 48 inches. Whatever the size, 1–2 inches should be allowed on the length and width for ease of stacking. This must be provided for in calculating the dimensions of the floor space.

Recent experiments carried out by the A.R.C. Ditton Laboratory with Bramley's Seedling apples stored in bins have shown that, if bruising is to be kept to a minimum, 21 inches is probably about the maximum safe height for fruit in the bin. No data are available yet for Worcester Pearmain or Cox's Orange, but it is safe to assume that a similar height will apply to these varieties. The capacity of a bin on a 40 inches × 48 inches base, filled with Bramley's Seedling to a height of 21 inches, is 15 bushels. This is the minimum capacity of bin from which greatest advantage can be obtained in bulk handling.

It may be some time before ideas crystallize about the most advantageous type of bin to use under British conditions. Individual experiences of growers will help to decide this. In the meantime certain guiding lines can be followed.

A primary requirement is that the bin should be rigid; any tendency to 'whip' during handling will result in bruised fruit. Materials that give a continuous surface, such as weather-resistant plywood or hardboard of outdoor quality, are more in favour than sawn-timber, which may warp and damage the fruit. All bins need cornerposts made from 3 inches × 3 inches timber, cut diagonally; and hardboard will need external 'Z' framing.

Ventilation must be adequate

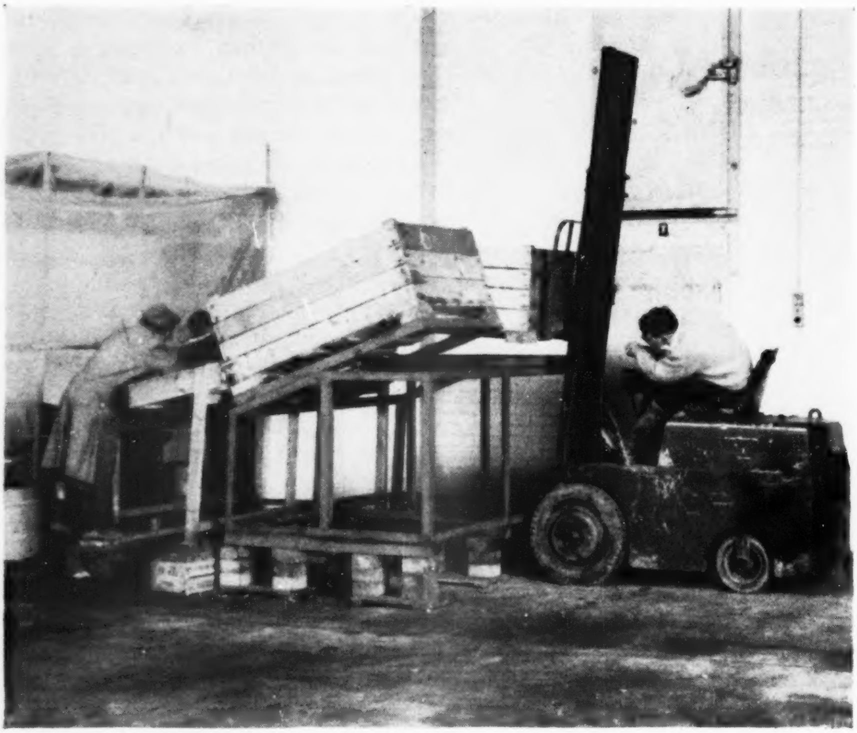
Apples stored in bins present certain problems which are less acute when they are stored in boxes or on trays. An adequate rate of cooling is important, both for cold and controlled-atmosphere storage. The storage space taken up by the timber of bulk bins is less than that occupied by the timber where orchard boxes or other smaller containers are used. The result is that with bins the quantity of fruit in a given store may be increased by 15 per cent or more. One effect of having the smaller quantity of timber in the store is to lessen the amount of moisture absorbed from the fruit. It is calculated that with bin storage in a 2,500-bushel store, the amount of water taken up by the timber may be reduced by as much as 350 lb, with a possible reduction in loss of weight by the fruit of 0·35 per cent. Another result of the greater density of storage will be to increase the load on the cooling plant over that incurred where orchard boxes are used. This must be taken into account in estimating the amount of refrigeration required.

Since the rate of cooling of the fruit depends upon the effective circulation of air around the individual fruits, care must be taken to ensure that ventilation is adequate. Provision must be made for free passage of air by openings at the lower levels.

There are three ways of ventilating a bin. The sides can be slatted, the bottom can be provided with spaces or slots, or slots can be left for a certain distance along the junction of sides and bottom, except at the door end. But care should be taken not to weaken the structure.

Experiments at the Luddington Experimental Horticulture Station showed that a slatted floor fitted to a timber-constructed bin increased the amount of damage to the fruit. Where in order to increase the degree of ventilation narrower slats were used, and hence more spaces, there was evidence of less rigidity. This resulted in increased bruising *throughout all layers of fruit* when compared with bins with wider boards which provided a lower degree of ventilation.

These experiments and others carried out by the Ditton Laboratory elsewhere have suggested that, with air circulation from ceiling to floor, (provided there is close-stacking in the store), a minimum of 4–6 per cent of the bottom



A fork-lift truck in action

surface as slotted area will provide sufficient ventilation between side and bottom. The amount of ventilation so given is sufficient to permit a satisfactory speed of cooling if the refrigeration capacity is adequate, and it will maintain a reasonably even distribution of temperature throughout the bin once the fruit has been cooled to storage temperature.

Apple scald

There is a prevalent belief, which has not been derived from direct experiment, that apples stored in bins are likely to develop more storage scald than apples stored in boxes. This may be so, and may be due to reduced circulation of air around the individual fruits. A quick answer to this problem is unlikely to be found, but investigations will shortly be under way. The use of oiled wraps to prevent scald is not, of course, possible where bulk bins are used for storage, since the individual fruits are not handled from the time of picking until they are removed from store for marketing.

In the meantime it would be wise to assume that 4–6 per cent is a reasonable amount of ventilation to provide.

Experience so far suggests that no serious difficulties are likely to be encountered by changing over from storage in boxes or trays to bins.

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Further information about the bulk handling of apples is contained in a free leaflet (STL 12), copies of which can be obtained from the Ministry of Agriculture (Publications), Ruskin Avenue, Kew, Richmond, Surrey.

HUMANE TRAPS

UNDER the Pests Act, 1954, the use of gin traps has been illegal in England and Wales since 31st July, 1958. Humane traps have been approved to replace them for catching rabbits, grey squirrels and stoats, weasels, rats, mice, or other small ground vermin.

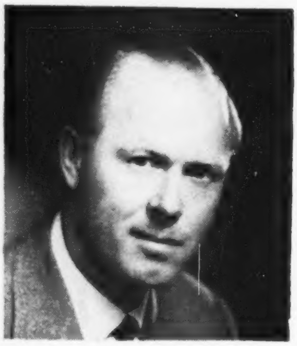
Before the ban could become effective, adequate supplies of suitable humane traps had to be available, and a Humane Traps Committee, comprised of experienced agriculturists, was appointed under the Chairmanship, first, of Mr. Roland Dudley, and from September, 1958, of Mr. R. B. Verney, to speed the development of humane traps and to advise on their approval. The Committee achieved their objective. Between July, 1954, and December, 1957, they examined 174 traps, but only the Imbra and the Juby rabbit and vermin traps, the Fenn vermin traps and the Fuller grey squirrel trap satisfied the high standards required. Since these traps were approved, the Committee has examined nearly 100 more, but none has been recommended for approval. As a general qualification for approval, the Committee would expect that in not less than 100 catches with rabbit traps 80 per cent or more would be kills, and the traps would be capable of catching rabbits on at least 75 per cent of the occasions on which they were sprung.

The Government also provided a fund of £5,000 for the payment of awards to encourage trap designers in their efforts to find suitable substitutes for the gin. Many years of patient experimentation and thought have gone into the new designs, and following the recommendations of an independent Panel, appointed by Ministers, under the Chairmanship of Mr. J. Scott Henderson, Q.C., the Parliamentary Secretary of the Ministry of Agriculture recently presented awards ranging from £100 to £1,000 to five designers who had been working on humane traps.

Traps for foxes

A sum of £2,000 remains in the award fund to encourage the development of humane fox traps. It will be no easy task to design a humane fox trap, and so far no fox trap has measured up to the high standards required for approval. Broadly, fox traps fall into three categories—killer traps (such as the Imbra and Juby traps for rabbits), cage traps and holding traps. Killer traps could be dangerous to dogs, lambs and people in the situation in which they would be set for catching foxes. Cage traps have been tried, but even under favourable conditions foxes are disinclined to enter them. A trap that holds the fox—or other animal accidentally caught in it—without injuring it may be a solution. It is hoped that the offer of an award from this fund will encourage designers to get to work on this problem. They should send particulars to The Secretary, Humane Traps Panel, Advisory Council on Rabbits and Other Land Pests, Government Buildings, Block B, Hook Rise South, Tolworth, Surbiton, Surrey.

Traps for other animals might later be brought within the Scheme.



Soil Research and Horticulture

C. BOULD

Organic matter ● Soil structure ● and factors affecting the availability of some plant nutrients

EVERY grower is aware that organic matter is desirable for good husbandry, that some organic residues when applied to the soil disappear more quickly than others, and that it is more difficult to maintain a high organic matter status in sandy soils than in clays. Recent research has helped to explain some of these observations. It is well known that the rate of decomposition of organic residues depends on the chemical nature of the constituents, the relationship between the carbon and nitrogen compounds, and on conditions that will help biological activity. It has now been shown that fresh leaves from a number of plants contain water-soluble substances (of a poly-phenolic nature) that will react with the nitrogenous constituents (proteins) to form insoluble complexes that are particularly resistant to biological decomposition. This has been demonstrated by treating casein (a protein from milk) with the water extracts from three plant species known to produce resistant litter. The precipitated complexes were then mixed with soil, in pots, and the rate of mineralization of nitrogen measured by the growth of birch seedlings. The results of this work suggest that these water-soluble plant substances, which cause the precipitation of plant proteins after ageing and death of the plant cells, are important in soil processes and particularly in the formation of raw humus.

Straw and sawdust

Straw and sawdust are often used for mulching purposes, particularly after planting trees and shrubs. Both of these organic residues have a high carbon/nitrogen ratio, and if they are incorporated into soil without supplements of nitrogenous fertilizer they will immobilize soil nitrogen and thus cause nitrogen deficiency symptoms in crops. Many years ago the decomposition of straw was studied at Rothamsted and the nitrogen requirement for the most favourable rate of decomposition was determined.

Less attention has been paid to the nitrogen requirement for the best rate of decomposition of sawdust. Recently, studies have been made on the rate of decomposition of pine sawdust in two loams of pH 5·5 and 5·4 respectively. The sawdust contained 0·13 per cent nitrogen and 45 per cent carbon on an

air-dry basis; that is to say, it had a very much greater carbon/nitrogen ratio than most straws, although some of the carbon compounds (particularly lignin) would be very resistant to biological decomposition. Calcium hydroxide (slaked lime) and calcium carbonate were added in some experiments in conjunction with supplementary nitrogen as ammonium or calcium nitrate. It was found that 14–20 lb of nitrogen were required per ton of air-dry sawdust (roughtly ¾ to 1 cwt of a nitrogenous fertilizer containing 20 per cent N) to produce maximum decomposition. Quicker decomposition was obtained by the addition of nitrate-nitrogen than by ammoniacal-nitrogen in the absence of added limestone or slaked lime, but when acidity was controlled the two nitrogen sources were equally satisfactory. When using ammoniacal-nitrogen, (i.e., ammonium sulphate) it is better to use ground limestone (calcium carbonate) to maintain neutrality; slaked lime is alkaline and may cause losses of ammonia by volatilization. During a period of 160 days, 58 per cent of the sawdust carbon was released as carbon dioxide. Some years ago, I found that the organic nitrogenous complexes formed during the decomposition of sawdust were particularly resistant to biological breakdown, and that the mineralization of nitrogen from sawdust composts was very slow, so they should be regarded as a source of organic matter rather than of plant nutrients.

When the same crop is grown on the same soil for long periods subsequent plantings often grow poorly in comparison with similar plantings in virgin soil, or soil never cropped with the species concerned. Tree crops subject to this phenomenon include peaches, apples and citrus. The main theories advanced to explain the growth reduction are (*a*) nutritional deficiency, (*b*) development of parasitic micro-organisms in the soil and (*c*) production of toxins either directly by plant roots or through microbial decomposition of the roots. Growth of a different crop, or incorporation of a different organic residue in the soil, may depress growth of the parasitic organism or speed up decomposition of an injurious toxin.

Canadian workers, investigating the peach replant problem, have found that microbial action on a part of peach roots was mainly responsible for the toxic factor frequently found in old peach orchard soils. And German studies have shown phloridzin (a kind of glycoside present in the root bark of apple) to be responsible for some of the apple replant problems. It is advisable, therefore, to rotate land used for nursery purposes and to introduce a grass ley, if possible, in the rotation.

Soil structure

The aggregation of primary particles (sand, silt and clay) into crumbs constitutes the micro-structure of soils. This can be brought about either by physical means (frost, wetting and drying) or by the addition of readily decomposable organic matter, or by synthetic soil conditioners. Certain forms of organic matter, particularly that formed by micro-organisms during the process of decomposition of organic residues, cause aggregation by 'sticking' together particles of mineral matter and groups of clay particles. The organic matter responsible for holding together the primary particles is more resistant to biological attack than is free organic matter. For this reason, and others, it is possible to maintain a higher organic matter status in an aggregated loam than in a sandy soil.

Build-up of soil organic matter, and improvement in soil structure, can be achieved by adding large amounts of farmyard manure or by temporary

grass leys. A comparison of these two methods has recently been made on a range of soils. Both treatments gave stable structure to clay soils, but drainage was increased under grass. Heavy dressings of farmyard manure built up organic matter in sandy soils but did not stabilize them; in contrast, three-year grass leys gave stable and highly permeable sandy soil. Where structural improvement is essential, a period under grass is likely to be much more effective than occasional dressings of farmyard manure. The latter, or more correctly its decomposition products, 'sticks' soil particles together and is particularly effective in clays, whereas sands need the fine roots of grass to bind the soil particles together.

Nitrogen and nutrients

Nitrogen is present in soil in both organic and inorganic forms. Normally before organic nitrogen can be utilized by plants it must first be mineralized by a series of biological changes. If the starting point is protein, then the sequence is normally protein→amino acids→ammonia→nitrite→nitrate. Generally speaking, the only decomposition products that accumulate in any quantity are ammonia and nitrate, but under abnormal circumstances certain amino acids may accumulate and cause trouble. It has been shown that a symptom in tobacco, known as 'frenching', can be caused by certain amino acids, and more recently a symptom in chrysanthemums, known as 'strap leaf', has also been associated with amino acid toxicity. Symptoms include chlorosis of new growth, green netting of leaves and narrow strap-shaped leaves that hook at the ends. The condition may persist for 2 to 8 weeks, causing mild to severe stunting of plants. The disorder is favoured by a relatively high soil pH, periods of high soil moisture levels and high soil temperatures.

Inorganic nitrogen is present as nitrate in the soil solution, and as ammonium-N, partly absorbed on the clay and humus colloids and partly fixed in the lattice structure of the clay crystals. Losses of nitrogen from soil may occur through leaching, denitrification and fixation. Denitrification, that is the process whereby nitrate and nitrite are changed into gaseous nitrogen, may be responsible for serious losses of nitrogen under certain soil conditions. It is a biological process, and the organisms responsible for it require anaerobic conditions (lack of air) and a source of easily decomposable organic matter. Therefore, waterlogging of soils is usually accompanied by losses of nitrogen through denitrification. The adverse effects of waterlogging in orchards, though primarily due to death of roots and subsequent reduction in root-absorbing capacity, may be accentuated by low nitrogen supplies.

Ammoniacal-nitrogen may be lost temporarily, so far as the crop is concerned, by biological or chemical fixation. Up to 10 per cent, or more in subsoils, of the total nitrogen in surface soils may occur as fixed ammonium nitrogen (as distinct from readily available adsorbed or exchangeable ammonium). This may explain why some soils are capable of supporting plant growth for many years without additions of nitrogenous fertilizer. The fixed ammonium (like non-exchangeable potassium) is probably released and becomes exchangeable with time.

In assessing the probable response to a nitrogenous fertilizer, the following facts should be considered. If nitrogen is applied as nitrate it will readily penetrate the soil profile after rain, because it is not adsorbed by the soil. Excessive rainfall may cause losses by drainage or, if the soil becomes water-logged, losses may occur through denitrification. If nitrogen is applied in the

ammoniacal form (ammonium sulphate) penetration of the soil profile is less rapid, losses by drainage (except in sands) are reduced, but temporary losses by fixation may be greater than with nitrate-nitrogen.

At present there is no universally accepted and reliable method for assessing nitrogen availability in soils, or for predicting the probable response of a crop to nitrogenous fertilizer. Total nitrogen, by itself, is not a reliable guide and it must be related to the amount and nature of the carbon compounds present. The amount of water-soluble mineral nitrogen present, after a period of incubation at controlled moisture content and temperature, appears to be the most promising analytical soil method. Recent work has shown that the mineral nitrogen in fresh soil, and in dried soil after a period of incubation, is related to the yield of some crops but not of others. For predicting the response of perennial crops to nitrogenous fertilizer, leaf analysis is more satisfactory than soil analysis.

Phosphorus and nutrients

Phosphorus occurs in soil in many different forms: water-soluble, in the soil solution; 'available', adsorbed on the soil particles; fixed, as insoluble compounds of calcium, iron and aluminium, and in varying amounts of organically-bound phosphorus. The amount of 'labile' phosphorus, that is the total amount of available phosphorus on which the crops may draw over a period of time, limits plant growth and its response to phosphatic fertilizer. Micro-organisms can make soil phosphorus available to plants by (1) mobilizing insoluble forms of phosphorus and (2) by producing organic acids, during the process of organic matter decomposition, that prevent the fixation of applied water-soluble phosphates. Recent work has shown that certain micro-organisms, when supplied with glucose, produce an organic acid (2-ketogluconic acid) that can attack very insoluble calcium phosphates, taking out the calcium and thus making the phosphate available for plant growth. One can understand, therefore, why additions of organic matter may increase the uptake of phosphate by plants from soil and why, on some soils, the response to phosphatic fertilizer may be greater when it is given in conjunction with organic matter.

Potassium/magnesium relationships

It is known that heavy dressings of potassic fertilizer to soils low in magnesium may induce magnesium deficiency in crops, and that wet seasons enhance magnesium deficiency. The adverse effect of one nutrient on the uptake of another by plants is called 'antagonism', so potassium is said to be antagonistic to the uptake of magnesium. These two plant nutrients are normally adsorbed on the clay colloids, but only a fractional amount of each is present at any given time in the soil solution. The amount of magnesium in solution is of course related to the total amount present in the soil, but it is also controlled to a large extent by the total amount of potassium present, and by the moisture content of the soil. Increasing the amount of soil potassium decreases the ease of replacement of exchangeable magnesium, thus reducing its concentration in the soil solution. Increasing the moisture content of the soil also increases the ratio of potassium to magnesium in the soil solution. Therefore, increasing the potassium supply and the soil moisture both decrease the amount of magnesium in the soil solution. As a result, if the soil is low in magnesium, crops become deficient and may show magnesium deficiency symptoms.

Soil pH and nutrients

It appears from recent studies that the most favourable pH for organic soils differs from that of mineral soils in relation to maximum availability of plant nutrients. Organic soils, with a pH less than 4, often have a nitrogen content of less than 1 per cent, whereas organic soils with a pH greater than 5 usually contain more than 2 per cent nitrogen. Thus the carbon/nitrogen ratio in the very acid soils may be as high as 60 : 1, whereas that of the less acid soils may be 30 : 1 or less. Obviously the nitrogen requirements of the two soil types differ greatly. In general, very acid soils require substantial amounts of nitrogenous fertilizer for satisfactory plant growth because of their low nitrogen content, high carbon/nitrogen ratio and poor microbial activity (especially bacterial). If the pH falls below 5, there is a marked reduction in nitrification. The ideal pH for maximum availability of most plant nutrients in wood-sedge organic soils seems to fall in the range 5·5–5·8, and 5·0 for sphagnum peats. This range is 1–1·5 pH units lower than that generally considered to be satisfactory for mineral soils.

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The Ministry's Publications

Since the list published in the April, 1962, issue of *Agriculture* (p. 34) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops (addresses on p. 104), from any Divisional Office of the Ministry or through any bookseller at the price quoted.

A.B.C. of Cookery (Revised) 5*s*. (by post 5*s*. 6*d*.)

This new edition has been thoroughly revised, bearing in mind the wide range of fresh and processed foods which are now readily available. It gives general information on storing food, cookery processes and terms, food values and menu planning. There is also an A.B.C. of food preparation.

LEAFLETS

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 2. Financing Improvements to Land and Buildings (Revised) 1*s*. 6*d*. (by post 1*s*. 9*d*.)

FARM MACHINERY LEAFLET

No. 17. Sugar Beet Harvesting (Revised) 6*d*. (by post 9*d*.)

FREE ISSUES

Obtainable only from the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey.

Free Calf Vaccination Service (New)
Poisoning by Agricultural Chemicals. APS 3 (Revised)

49. Battle, East Sussex

S. J. Kingston
District Advisory Officer

Per Bellum Patria—Through Battle came the country

BATTLE was so called because it was the site of a well-known event in English history—the Norman victory of 1066. The town itself has some 4,000 inhabitants, there is a market of local importance, and the Abbey and other historical remains make it a centre of interest for tourists and visitors.

Battle Rural District covers an area of 190 square miles, includes 32 parishes, and is that part of East Sussex adjacent to the Kent border with a coastline extending from west of Bexhill almost to the Dungeness seaboard of Romney Marsh. It includes the seaside resorts of Hastings (most westerly of the original Cinque Ports) and Bexhill, and the two ancient towns of Rye and Winchelsea. The scenery is superb and offers great variety.

Most of the soils of the district are derived from the geological formation known as the Hastings Beds, which consist of the alternating sands and clays of the Tunbridge Wells Sand, Wadhurst Clay and Ashdown Sand. These formations are dissected by the alluvium of the rivers Rother, Tillingham and Brede, and are flanked on the south-west and south-east by the alluvium of the estuarine marshes. An intrusion to the surface, unique in the south-east, is a faulted seam from the Purbeck Beds at Mountfield where gypsum is mined on a larger scale than anywhere else in Britain, providing the only considerable industrial employment in the area.

The many steep slopes, frequent interspersion of woodland areas, and small fields with high hedges add to the difficulties of the district. The coppicing of chestnut for spile making, etc., is a recognized activity. A large proportion of the woodland has now been taken over by the Forestry Commission.

Arable cropping as such, with the exception of kale, is gradually declining and farmers are concentrating on grassland. Reseeding has been widely practised, and with careful grazing management and the necessary applications of lime and fertilizer, long leys can remain productive for many years. Silage has been made fairly extensively since 1940 and the quantity is being increased on many farms to replace kale, which cannot easily be strip-grazed because of soil conditions. The decimation of the enormous rabbit population greatly increased production from these holdings and allowed a wider programme of reseeding.

The holdings in the area are, on average, under 100 acres. Hop growing, once universal throughout the district, is now limited to the Kent borderlands where Messrs. Guinness have the largest single hop farm in Britain. Hop-picking machines are quickly replacing the Londoners who once relied on the hop harvest to provide holidays with pay.

The cattle enterprise is centred on milk production, with an increasing interest in beef and fat lamb production for the late retail trade. The once-popular Dairy Shorthorn is gradually being replaced by the other breeds, especially by British Friesians. The local Sussex breed of beef cattle is of excellent conformation, deep red in colour and thrives on poor soil and under difficult conditions. It holds pride of place with farmers and butchers alike, and Sussex bulls are used almost exclusively when crossing the dairy breeds to produce prime beef at two-years old.

Sheep-keeping on the upland farms has increased since the war. The more prolific breeds, such as Cluns, have appeared on some farms but there is a fairly general loyalty to the Romney Marsh ewe for crossing with a Down ram.

While there have been more poultry than pigs, neither has been a general part of the farming pattern of the area, although intensive table poultry production has expanded in parts of the district in recent years.

The low incomes obtained from most holdings allow little margin for the improvement of buildings, field drainage and other fixed equipment, which is often of poor quality. The Farm Improvement Scheme has been of some assistance in providing buildings on these farms which, if they could afford housing for all cattle during the winter, would go far to maintain the quality of the grassland. The Small Farmers Scheme has been of considerable help to many of the farmers in the area in supplying much needed working capital.

The early and almost complete breakdown of the landlord-and-tenant system has allowed a large number of newcomers to start farming in the area. The attractions of a favourable climate and proximity to London may in some cases have over-ridden the considerations of poor soil and difficult fields, and the husbandry skill necessary to deal with them has not always been achieved.

Moving eastward, the quality of the soil improves and with it the size and prosperity of the farms. Towards Rye, hops are grown on many of the farms and an appreciable acreage is devoted to fruit. Both of these enterprises have become highly specialized in recent years.

The eastern extremity of the district is Walland Marsh, commonly treated as part of Romney Marsh, of which it is the most recently reclaimed area. Here is an alluvium of great depth comparing favourably with the best soils in the country. The outstanding feature of the area is the quality of the pasture, which is capable of very dense stocking with sheep in summer. The Kent or Romney Marsh breed is adapted to these conditions of grazing, and outwintering them on the upland farms allows for a partial restoring of the pastures. The Kent ewes are crossed with rams of the Down breeds to provide suitable fat lambs for present-day trade.

Improved drainage has led to the development of arable farming on the Marsh since the war, and with a high degree of mechanization, potatoes, canning peas, cereals and grass seed can show an even higher return than heavy stocking with sheep. The possibility of manganese deficiency in the crops is recognized, and spraying with manganese sulphate is a routine practice; copper deficiency in stock is also likely to occur. The level of technical knowledge amongst the farmers in the Romney Marsh area equals that of any part of England and the farming picture there is most impressive.

In fact, the Battle district generally is not without examples of good farming overcoming the difficulties of poor soil and situation and, by persistent endeavour, winning a fair economic return.

W. J. PINFOLD
Agricultural Land Service, London

The Case for the Cowshed

THE number of farmers who have changed, or are changing, from cowsheds to loose housing systems suggests a widespread belief that the traditional cowshed has outlived its usefulness.

Usually the reasons given for conversion are economy of labour and more efficient milking, but these theoretical advantages do not necessarily reduce production costs. To cover the cost of conversion there must be the greatest possible savings in labour, and these do not come automatically with the reorganization of the building layout. Too often the existing buildings have to be used when they do not lend themselves to a really good layout. But even if every conversion scheme produced the ideal building layout, there is still the need to develop working methods and management and husbandry practices which will realize all the economies of the housing system.

Economic and work study surveys show that although labour requirements in the average yard-and-parlour system are less than in the average cowhouse, they are still higher than in a really well organized cowshed.

The cowshed is criticized because farmers continue to use the traditional working methods of the past. These obscure the many advantages the cowhouse has to offer. The possibility of giving every cow individual attention must be attractive to the true stockman, and for those who want to record feeding costs there is no better way of rationing both concentrates and bulk feedingstuffs. Yokes and mangers can, of course, be provided in yards, but this destroys the adaptability of the building and makes it no less specialized than the cowshed.

Some claim that the parlour gives faster and more efficient milking, but with a good work routine in the cowshed it is possible to milk more cows per hour than in a parlour with one unit to each stall, while the more expensive two stall-one unit parlour will only improve performance by between 2 and 5 cows an hour. Any other differences arise from increasing the number of units, and although 3 units are normally regarded as being the limit in a cowshed, much can be done to reduce the routine time and avoid excessive walking by using a trolley to carry equipment and by pumping milk straight to the dairy from a mobile tipping churn.

While the cowshed can be criticized because the cowman has to stoop to milk, this applies to all single-level parlours and the working posture is more comfortable than in the still popular two-level-abreast parlour.

Cleaning is probably the worst feature of the cowshed, but even this can be simplified. With traditional methods, cleaning need only take $1\frac{1}{2}$ minutes per cow per day, and this time can be halved if dung channels are unobstructed and doorways open the full width between heelstones to allow the use of a

scraper. This is no worse than the problem confronting so many farmers with loose housing systems who have to scrape large areas of concrete and to contend with slurry at the silo face. They also have to wash the holding area every day, so that the daily work load is about the same. Where the cowshed cleaning time is excessive, it is usually found that too much litter or litter of the wrong type is being used. The time required to litter the standings is considerably reduced when sawdust is used, and the smaller volume of manure to be removed is a help where barrowing to the dungstead is unavoidable. There can be no excuse for the farmer who finds it necessary to fork manure from a barrow on to a heap at the dungstead when a ramp or pit can always be provided to allow barrows to be tipped. Yet it is this sort of unproductive work which creates the impression that the cowshed is obsolete.

Look twice before spending

It is questionable if the handling of bulky foods in the cowshed takes longer than in the majority of yards. The popularity of silage seems firmly established, but there are not many farmers who can make sufficient to save labour by uncontrolled self-feeding. Controlled feeding usually involves cutting and carrying. Whether this is to a cowshed or a feeding apron, the silage can be placed in the mangers at the rate of 50 lb per minute provided it is forked straight from the trailer. It is only when the total quantity is large enough to justify mechanical loading and the use of self-emptying trailers that a feeding apron is advantageous.

Before incurring a lot of capital on loose housing it seems essential for the farmer with a serviceable cowshed to re-examine his cowshed routine. He should determine the potential performance of his existing buildings if he is to make a valid comparison with the labour requirements of the proposed buildings. As often as not this will show that labour savings are insufficient to cover the cost of the building improvements, and so the size of the herd is increased to give a return on capital. The result is an increase in production without an increase in productivity.

For those who have no straw and must rely on slatted floors to provide reasonable yard accommodation, there can surely be no difficulty in reaching a decision. Adaptability is lost; building costs are increased; the disposal of slurry presents problems which could lead to the extra cost of an organic irrigation system. Unless changes have been justified by a detailed analysis of the farm business, it seems a high price to pay for a few extra cows and doubtful savings in labour. A building is only as good as the man using it, and the extravagant claims of labour-saving in yards and parlours are often due to the breaking of bad work habits rather than the inherent qualities of the housing system.

Correction

Short Guide to the Annual Review, 1962. (April issue.)

Table 2 (p. 42): "Total Expenditure" (1961 62 forecast), *read* £1,321·5 million instead of £1,269 million. "Other expenses" (1961 62 forecast), *read* £97·5 million instead of £45 million.

Investing in Agricultural Land

Reported by ***Sylvia Laverton***

THROUGH the increasing incidence of death duties on inherited wealth, the number of rented farms in England and Wales has declined dramatically in the past sixty years until today about half of all farmers are owner-occupiers. But the landlord-tenant system is not necessarily doomed to eventual extinction. As MR. H. E. G. READ told the Farmers' Club on 11th April, changes in custom and a series of Agricultural Holdings Acts have developed the system to the point when it is far from being dependent on traditionally-owned estates for the supply of farms to rent. Mr. Read, who is Agent to the Derbyshire Estates of the Chatsworth Settlement Trust, pointed out that anyone can become an agricultural land owner by buying or inheriting a single farm, or even a single field, and renting it to a farmer. Indeed, one half of all rented land in England and Wales is now owned by people with less than 1,000 acres.

"I believe that the decline in the number of let farms has gone far enough" said Mr. Read. If the present level is to be maintained and increased, new potential investors are needed to purchase owner-occupied land offered with vacant possession as well as rented land coming on to the market. As the single-farm owners' service to their tenants must inevitably be restricted through lack of capital resources, the farming community should look to the emergence of a new type of larger owner to keep up the supply of rented farms. To avoid the obstacle of inheritance taxation, the field would be restricted to companies, investment trusts, and so forth, which are "immortal in the death duty sense".

To such investors, agricultural land offers an excellent hedge against inflation, provided its value continues to appreciate as in the past two decades. Taking 100 as the base for 1958, vacant farms reached 385 by 1959 and rented farms 347, as compared with 305 for equity shares, 70 for Government stocks and 280 for the pound sterling. After adjusting for the injection of new capital, the true capital appreciation for vacant farms was about 20 per cent, and for tenanted farms 10 per cent between 1938 and 1959. During this period rents rose much less steeply, but since the 1958 Act, which enabled an arbiter's award for rent to follow market prices for new letting, such rents are now about three times the pre-war figure after allowing for genuine capital improvements. Mr. Read added that both rents and sale prices are becoming more sensitive to the quality of the fixed equipment provided. Before the war agricultural land rated a security value comparable with that of Government stocks. Today it falls midway between industrial

companies with and without growth prospects, and if purchase price seems higher than warranted by income return, in fact this reflects the chance that agricultural land may acquire more valuable uses, the possible residential premium involved, and the land rebate on inheritance tax.

The 45 per cent rebate allowed on death duties in respect of agricultural land, introduced in 1925, was intended to prevent the sale of traditional estates forcing tenants to buy their holdings at heavy mortgage rates. It has had the unfortunate sequel of attracting the "deathbed buyer" who, by transferring his wealth into agricultural land, thereby secures for his heir an inheritance 2½ times what he would otherwise have received, even allowing for a 10 per cent loss on resale.

Thus the wealthy deathbed buyer can afford to outbid the legitimate market. Shorn of the death duty benefit, the inflated price becomes less attractive to the genuine investor than other possible investments. This out-of-date fiscal expedient is actively preventing the extension of the public company idea from commerce and industry into the field of estate ownership. Yet this new pattern of land ownership must come, said Mr. Read, if we are to retain a reasonable ratio of let land with its special attraction to the young and progressive farmer.

Investing in agricultural land involves the owner in a management problem which Mr. Read believed should be tackled in a more business-like manner than is customary. He emphasized the importance of accounting for capital as well as for rents and outgoings and recommended the standard account for landed property investment, published in booklet form recently by the Chartered Land Agents' Society. Deploring the tendency to regard buildings as everlasting—"something that is ingrained in us as a nation"—he advocated the accumulation of a realistic depreciation reserve from rental income; re-equipment and rebuilding, he said, both increase gross income and reduce repair costs. "Carefully planned and executed, an improvement to a farm should at least maintain its true investment yield and value: say a net return on capital of 3½ per cent—one would be doing well to achieve 4 per cent".

As compared with tax treatment of an industrial investment, the real benefits for agricultural land are the ability to charge all improvements to property against income over the comparatively short period of ten years, and the right to reclaim excess relief, from repairs and renewals, or improvements, against other income. It might pay the potential purchaser of an agricultural estate to buy run-down farms, so as to benefit from the grants available and the tax relating to improvement expenditure, provided the land is basically productive and fertile. There is also an advantage in having other non-agricultural investments in the same ownership, against the income from which tax relief can be obtained to the extent that renewal and improvement costs exceed the agricultural income.

For a gross rent of around 5 per cent on capital value, allowing 1½ per cent for repairs, management and buildings renewal reserve, the net return would be 3½ per cent for a farm modernized by grant aid and tax relief and not in a fashionable residential area. This would be an attractive long-term holding for a pension fund or investment trust having other investments.

As in any other business enterprise, good management is essential and Mr. Read predicted the re-emergence of the land agent as a full-time salaried and professional manager to a public company with assets in land but with its ownership capital divided among countless shareholders.

Agricultural Chemicals Approval Scheme

Additions to the 1962 List of Approved Products

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The Second List of Approved Products was published on 1st February, 1962.

INSECTICIDES

DDT—*Liquid Formulations*

Profarma DDT 25% Emulsifiable Concentrate—Profarma Ltd.

FUNGICIDES

DINOCAP—*Liquid Formulations*

Karathane Liquid—Murphy Chemical Co. Ltd.

THIRAM—*Wettable Powders*

Bugges Thiram 80% Wettable Powder—Bugge's

HERBICIDES

2, 4-DB with MCPA

For control of many annual and perennial broad-leaved weeds, especially knotgrass, redshank and black bindweed, in cereals, undersown cereals and seedling clovers.

Sodium Salt Formulations

Embutox Plus—May and Baker Ltd.

DINOSEB (DNBP)—*Amine Salt Formulations*

Daminox—Baywood Chemicals Ltd.

MCPB with MCPA—*Potassium and Sodium Salt Formulations*

Trapon Plus—Profarma Ltd.

WHEN DESTROYING WOOD PIGEON NESTS

METAL poles, even wooden ones when wet, are conductors of electricity, and fatal accidents can easily occur when using them near overhead electric cables. Use non-conducting fibreglass poles instead. Incidentally, only these poles are now eligible for the grant of 50 per cent of the purchase price, made through Rabbit Clearance Societies.

The last week in July, followed up in the second week of September, are the effective periods for nest destruction.

IN BRIEF

N.I.R.D. Jubilee

The National Institute for Research in Dairying celebrates its 50th anniversary in June. Two Open Days, on 28th June (10.30 a.m. to 5.30 p.m.) and 29th June (9.30 a.m. to 2.30 p.m.), will enable visitors to see something of the scope of the Institute's work.

There will be tours of the farms to see experimental work on feeding, management and milking, demonstrations in the laboratories and dairy, and a review of the handling and treatment of milk. One demonstration will be devoted to the manufacture and quality of cheese; another to the nutritional value of milk and of dairy products.

The use of radioactive materials as an aid to research will attract many visitors, while the more mechanically minded will make for the items of interest in the engineering workshops.

Details of the full programme can be obtained from the Institute at Shinfield, Reading, Berks.

Meat Research

The announcement in Parliament on 1st February that the Government proposed to set up a meat research organization was followed on 19th March by a meeting between representatives of the Government and of the meat industry, at which further information was given about the Government proposals.

The Meat Research Institute, which will meet a widely recognized need, is to be set up by the Agricultural Research Council. The research on meat now carried out at the Council's Low Temperature Research Station at Cambridge will be transferred to the new Institute, which will also undertake new work, in particular, basic studies on the growth and properties of meat tissues, and factors influencing quality. In addition, the Institute will be concerned with particular problems of meat from cattle, sheep, and pigs; work now in progress on poultry meat will continue. The Institute will serve the country as a whole, including any special interests of Scotland, Wales and Northern Ireland.

An Advisory Committee is to be appointed, including scientists, producers and processors of meat, who will be able to advise on the problems of the meat industry.

The capital cost of the Institute is estimated at about £500,000 and the recurrent cost at £100,000 a year in the initial stages—not large sums in relation to an industry valued at around £400 million. The Government is calling upon the meat industry to contribute approximately half the capital and recurrent cost. To this end a levy, which will be of the order of 6*d.* a head on cattle, 1*d.* a head on pigs and ½*d.* a head on sheep, is to be imposed. To cut down administrative costs, it is proposed to use the Fatstock Guarantee Scheme machinery for collecting the levy, as is already done with the Pig Industry Development Authority Levy. This means that the levy will be restricted to animals presented for certification and will be divided between the producer and the first purchaser. It will not be introduced earlier than 1st April, 1963.

The Agricultural Research Council considers it desirable that the Institute should be closely associated with a University having departments concerned with the appropriate basic sciences and, if possible, a veterinary school with a special interest in animal husbandry. Negotiations have been opened with the University of Bristol for a site near Bristol which would meet these requirements.

Wanted: Clean, Undamaged Potatoes

A good deal of ingenuity has been shown by agricultural engineers in the pursuit of a really efficient, smooth-running potato harvester, but complete success still eludes their grasp, though some British harvesters do a satisfactory job in good conditions. A recent enquiry, covering countries of both Eastern and Western Europe, revealed few ideas or developments which have not been tried in Britain. Though there are alternatives, as demonstrated by one notable British harvester, the chain-web elevator is the basic soil-separating device used on most harvesters in all countries, and, as in Britain, the most generally useful secondary clod and stone separators at present are various types of adjustable inclined belts, which can be set so that potatoes roll down while the more angular stones and clods are carried up or along by the belt.

Mr. Claude Culpin reviews some of the developments in the Spring issue of the *N.A.A.S. Quarterly Review*. A stone separator recently developed in Germany consists of contra-rotating nylon roller brushes. When a mixture of stones and potatoes is fed in a thin stream on to the rollers, most of the stones pass between the bristles while most of the potatoes pass over them.

Mechanical soil and clod separation almost inevitably results in some tuber damage, and in a typical harvester this can be reduced by covering the web of elevator chains, riddles, and deflector plates with a soft material. A 3 mm thickness of rubber was found satisfactory and superior to plastic in Swedish experiments. Unfortunately, soft coatings on the machine produce little improvement in stony conditions, where much of the damage is due to knocking the potatoes against the stones.

Harvesting trends in the U.S.A. are very like those in Britain. The general use of cut seed, spaced at 8–9 inches in wide rows, tends to produce tubers of a more uniform size and somewhat larger than is common here. Farmers are often not interested in harvesting tubers smaller than 1½ inches in diameter, and consequently widely-spaced rods can be used on elevator chains and other soil-separating mechanisms.

In the damp, silty soils of the Red River Valley area, an 'indirect' method of harvesting is fairly widely used to overcome the difficulty of soil clinging to the potatoes. The crop is lifted by a 2-row elevator-digger fitted with a cross conveyor which puts the potatoes into a fairly narrow windrow. When, later, a single-row harvester picks up the windrow, the soil usually breaks away and gives a reasonably clean sample.

Forward Creep Grazing of Lambs

More profit per acre from sheep implies more sheep to the acre. It follows, of course, that a stage will be reached when the ewe becomes a serious competitor with her lambs for the available pasture. This is all the more serious because the lambs need the best grass when the ewes' milk supply is falling off.

The rotational forward creep grazing system enables lambs to get the best of the pasture under conditions of high level stocking. Eight ewes (plus their lambs) per acre is a common rate, and some fields can carry more than this. The field chosen should have been free of sheep for the previous six months at least—twelve if possible. A new ley gives the best results, though it is not essential.

Ten cwt slag per acre the previous autumn will encourage the clover, and sheep usually graze closely after slag. Nitrogen must be used with discretion; too much coarse grass is a liability. It is usual to give 40 units of nitrogen per acre in early spring and a top dressing at the rate of 30 units per acre during the grazing season, only when it is necessary to encourage more grass.

The field is usually divided into six sections. Creeps are fitted into the dividing fences, and there are usually two hurdles which can be opened when the ewes are moved from one section to the next. The creeps are closed when the ewes have moved forward, to prevent the lambs from running back.

In the early part of the season the milk supply of the ewe must be stimulated as much as possible by giving her all the good pasture she can eat, and she is moved forward frequently—usually every three days—to make sure she gets no check. The ewes get nearly all the grass because the lambs are young and eat very little, but some of the more precocious will go through the creeps and the rest will soon copy them. As the lambs grow they will eat more and more grass, and this in turn will force the ewes to clean up more closely behind them. This arrangement works very well because the ewes need progressively less of the best pasture.

Most farmers start to sell lambs when they reach 80 lb live weight. The best of the singles will then be 10–12 weeks old. When the concentration reaches 14, or even 16, per acre, the disposal of some lambs as early as possible gives those that remain a better chance of getting fat, but few farmers would claim to get all the lambs away fat on this system. Those that remain unsold at the end of July could be finished on rape, or they could be sold as stores.

All the available grass can then be used by the ewe flock so that they will come to tupping in good condition. This will ensure a good lamb crop the following year.

Farm Business Association in Somerset

Practically all branches of farming have Associations to further their educational interests, but farm finance seems to be an exception. Attempts have been made to co-ordinate interest in this sphere by arranging talks for bank managers and accountants, and they have met with some success. But it was thought in Somerset that a better way to tackle the problem might be to invite interested bodies to get together with the object of developing improved farm management techniques.

With this in mind, representatives of local banking, accountancy, N.F.U., discussion groups, Bristol University, N.A.A.S., the press and farmers, were invited to a preliminary meeting at Winscombe, near Axminster, under the Chairmanship of Mr. Ted Owens, and it was decided to form a local Farm Business Association.

Programme planning, data processing and farm budgeting, are fast becoming bywords in the industry, but farmers cannot be expected to develop new thinking without some basic education. It is the chief aim of our Association to reach a better understanding of what is involved so that they can further education on farm management in the area. There is no conflicting interest. All agree that it is vital that the new, advanced techniques should be applied properly and that investment and development be better directed.

A most gratifying result of the Association's activities has been increased consultation in farm management cases at an early stage. Bank managers are being particularly co-operative and are becoming increasingly interested in the redeployment of available capital in agriculture. Accountants, too, are being as helpful as possible. In fact, an invitation to all local bank managers and accountants to attend a general open meeting on the subject of "Capital in the Farming Business" met with a full response; over 100 people were present.

It is difficult to train farmers and accountants to become more 'farm-planning minded' without swamping the available advisers on the subject. It may therefore be better to extend associations of this kind geographically rather than to concentrate on an intensive local campaign. In consequence it is intended to keep the present Association small so that it can develop its interest and influence effectively. But there is certainly scope for the development of similar associations in other districts, and these might eventually coalesce to cover a much wider area. In the meantime co-operation between all parties interested in farm economics is proving of great value towards a reasoned approach to farm management problems.

T. E. Wathan

Books

The Pig: Modern Husbandry and Marketing. Edited by W. T. Price. Bles. 42*s*.

Easy reading by all those associated with the pig industry—farmers, teachers, students, advisory officers and those concerned with processing and marketing—is the declared target of this book. Certainly, for the cost of less than a reasonable profit on one baconer, it offers a wealth of information to anyone contemplating pig farming. Eight authors have contributed separate sections, covering particular aspects, and in the main these contributions are very good. But the book has some weaknesses: there is a tendency to repetitions, and there are some omissions.

After reading the first chapter on the economics of pig husbandry, the beginner will still be asking whether to go for pork, Wiltshire bacon or heavy hogs, and although the producer of Wiltshire bacon will already know of the effects of gradings on profits, the beginner might have been given a more definite warning. Systems of pig farming are discussed, comparing indoor and outdoor management, and rightly it is stressed that the system should be determined primarily by the type of farm. A gradual movement towards the more intensive types of management is predicted. Details of most breeds are given and systems of breeding are discussed, with comment on progeny testing and boar performance testing and practical details of management.

A chapter is devoted to housing, and there are useful photographs and plans. Several systems of housing are described, but an indication of the results obtained from *all* the systems would have helped the reader; similarly some information on labour requirements would have been welcome; work study is virtually excluded from this chapter. Nutrition and feeding are well covered in some detail. Closer collaboration between authors would have helped the reader on some points. For example, on page 167 copper is listed as an essential nutrient, with the statement that the storage of copper in the liver indicates possible toxicity, but there is no evidence that the health of the pig is affected. We are left until page 222 to be warned of the danger of excess—jaundice, acute haemorrhagic enteritis and even death.

The section devoted to market requirements and carcass quality is stimulating and more than a little biased in favour of the heavy hog. The arguments are convincing and many of them may be right, but some have been stretched to the limit. The statement that restriction of diet can produce hard, leathery or stringy lean and soft fat of poor quality is sufficient to scare a beginner from Wiltshire bacon production. Perhaps that is the purpose, but a more objective view would have been better, or at least a few arguments for the other side might have been included.

The beginner will learn much from this book, but he must also read others; the established pig farmer will gain supplementary knowledge and explanations, and the final-year student is provided with enough material for critical review in several seminars.

J.D.I.

Work Study in Agriculture. A. K. Fraser and G. W. Lugg. Land Books. 63*s*.

There are plenty of publications from which you can obtain a general appreciation of work study and the part it can play in improving agricultural efficiency. There are also various manuals which describe its more elementary techniques and their application on the farm. But this is the first formal, disciplined textbook on the subject. It may well also be the last. Revisions will presumably be needed as the years pass but it is unlikely to be superseded in our time, for it is a model of its kind. It is written by two of the most experienced men in the country; it is comprehensive in scope, detailed in treatment and lucid in style; and its arguments and explanations are admirably supported by examples from farm investigations.

The book begins by emphasizing that work study is essentially an aid to management, in this case farm management, and showing how farm management techniques and data can be used to identify the enterprises to which work study should be applied. It continues with a description of method study, which is a means of improving efficiency by the investigation of particular problems, and includes en route sections on the human factor and the principles of motion economy. It then deals with work measurement, which is a means of establishing the times required for particular jobs under particular circumstances. And here there is a discreet call to action.

The authors consider that the real future of agricultural work study lies in the collection of 'masses' of the type of data that work measurement makes available. This, they claim, would enable work-routines to be checked and improved by advisers trained only in the elements of work study without wearisome and costly investigations by specialist staff. In fact, it would allow work study to be applied wholesale instead of retail. But the collection and dissemination of such data implies the existence of some central body to brief the specialists on the information required, co-ordinate their work and collate the results; and at present the formation of such a body is still a matter of discussion. Indeed, its absence is one of the causes of the slow growth of agricultural work study to which Lord Netherthorpe refers in his preface to this book. The authors would, however, have strengthened their case by defining more precisely the properties and functions of the different types of data to which they refer.

This, then, is the definitive book on agricultural work study. It is, however, expensive. Further, most readers will find much of it of potential rather than actual interest, for it includes, particularly in its chapters on work measurement, a great deal of detail and methodology suitable for the research-worker but well beyond the needs of even the most advanced field-practitioner. But this is inevitable in a book which gives the whole subject the whole treatment from student-level to consultant-level and beyond.

N.H.

Agricultural Power take-off Shafts and Guards. Part 1. (B.S. 3417). British Standards Institution, 2 Park Street, London, W.1. 5*s*.

The the first part of this new British Standards publication refers to power input connections and yokes, and its intention is to limit the variety of connections at present in use in farming. This would help the designers of tractors and implements, and benefit dealers who have to keep stocks on their premises. Eventually it should improve the interchangeability of implements on farms. In addition to the Specifications with the dimensions which it is hoped will become standard, a table and graph are given as guides to a designer in finding the most suitable size of shaft for a given applied torque and torsional stress.

H.J.H.

Water: Miracle of Nature. THOMSON KING. The Macmillan Company, New York. 7*s*. 6*d*.

Nowadays water is rarely out of the news. In 1959 its absence caused a drought in this country which affected many rural areas and even endangered the water supply to some of our largest cities. In the following year disastrous floods—particularly in the west country and Wales—disrupted farming. In February of this year, the House of Lords rejected certain clauses in the Manchester Corporation Bill which sought powers to utilize yet another lake, Ullswater, in the Lake District, in respect of a supplementary water scheme that would have cost some £5 million. Even the favourable rainfall distribution of last year takes its share of the blame for the increased marketing of livestock and the consequential increase in Government subsidy.

Those concerned with agriculture, therefore, need little persuasion to read a book on the subject of water. There is much to interest them in Thomson King's book which, in the space of 213 pages, tries to deal with all aspects of water. It is, of course, essentially a book for the general reader. An attempt has been made to set the subject of water fully in its context, including the role that water has played in the historical evolution of the earth and of life on this planet. If a criticism is to be made, it is that the author, in order to keep within the limitations of a paper back edition, has inevitably had to condense his treatment of the subject. Thus it is disappointing that some modern developments, recent techniques used for the distillation of water, have received scant attention.

It is symptomatic of the times that the last chapter of the book is devoted to the importance of developing a comprehensive policy for the conservation of water. Although this chapter draws mostly on the U.S.A. for examples, the problem is giving similar concern in this country.

G.W.F.

Contemporary Botanical Thought. Edited by A. M. MACLEOD AND L. S. COBLEY. Oliver and Boyd. 30*s*.

This volume contains eight lectures given to the Botanical Society of Edinburgh by eminent botanists, who were asked to summarize the present state of knowledge in their particular fields, relating it to past theories, current problems, and lines of future advance. The centre-piece is a comprehensive survey of plant genetics; the mechanism of inheritance provides a link

with the chapters on evolution and taxonomy which are both concerned with the basis for classification. Genetic control of form and function is the link with morphology, and the role of the nucleus and the cytoplasm leads on to the study of other cellular structures, made possible by the electron microscope, and described in the chapter on plant cell structure.

The chapter on physiology is historical in outline and traces the development of theories on plant metabolism and the vegetable soul to the analysis of growth, development, and reproduction, in terms of co-ordinated chemical activity within cells, which are themselves chemically integrated within the plant. The chapter on mycology indicates the modifications which may have to be made when general concepts relating to the higher plants are applied to the special case of the fungi. The chapter on ecology is perhaps the most obviously relevant to agriculture, with emphasis on the complex dynamic relationship between climate, soil and vegetation, and on competition with a plant community.

The book is one for the academic rather than the agricultural botanist, but as the latter ultimately depends on the steady increase in fundamental knowledge about the plant kingdom as a whole, there is need for mutual comprehension and respect. This should justify the effort required to study this stimulating book which, as the editors claim, provides the necessary material for synthesizing a composite picture of botany as it advances into the second half of the twentieth century. *P.S.W.*

Ask the Fellows who cut the Hay. (Second edition). G. E. EVANS. Faber and Faber. 30*s*.

The first edition of this book appeared six years ago, but already many of the people whose recollections and tales Mr. Evans presents so sympathetically have died. With them died some of the few remaining personal sources of information on a manner of life which was once that of the normal Englishman, but which is now no more than a fading memory.

Mr. Evans was only just in time to produce one of the last—and one of the best—descriptions of the Old English village written with the aid of people who were born in it and whose formative years were spent there.

A lifetime ago the village of Blaxhall in Suffolk was recognizably part of the England of Young, of Tusser, and even of Chaucer. It was a closed, limited, tenacious community, still essentially dependent on local resources exploited by local skills, still continuing much of the peasant tradition. Mr. Evans enables us to see it, almost to visit it, through the memories of the elderly men and women to whom he introduces us.

The shepherd, the cottage housewife, the farmer and their various contemporaries tell us of their work and their play; of their methods of farming; of implements and household utensils now forgotten; of baking and brewing, stone-picking and bird-scaring; of stories, customs and frolics. The vivid, detailed, unsentimental picture they give of a rural society so near to us in time, so remote in assumptions and realities will attract any reader. In particular so well has Mr. Evans caught the words, it will attract any reader who knows East Anglia and force of Suffolk speech.

I have never been to Blaxhall, but this book took me back unerringly to a nearby village twenty years ago, and I heard again the horsemen discussing last night's tempest, saw the morning's 'dag' on the barley, listened once more to tales of Black Scutch, the Reydon coach with its headless driver, and the wise woman who found the bailiff's watch for him.

Few men from the Shires (those parts of the country which lie outside the borders of Norfolk and Suffolk) can know an East Anglian village as well as Mr. Evans has come to know Blaxhall. Few can have put their knowledge to better use.

The old photographs and the Bewick decorations which illustrate this book are a delight; so, indeed, is the entire book.

N.H.

Commercial Egg Production. W. G. R. WEEKES. University of Durham. 5*s*.

In this booklet Mr. Weekes describes, with much statistical data, the economics of egg production in 50 flocks, varying in size from 41 to 2,948 birds, on both battery and deep litter systems. Hybrid birds were used in batteries, while hybrids and non-hybrids were used on deep litter. The sample is therefore a very heterogeneous one and the average data for the three 'breed and system' groups of flocks are not very conclusive. To counter this admitted limitation the 'best flock' figures are given as case-studies of each of the three groups.

The results of this survey (which, unfortunately, are a year out of date already) show that half the flocks suffered losses of varying degree in 1959-60, which was, of course, a year of low egg prices.

Even so, several of the flocks made profits of upwards of 10*s.* per bird, after charging for family labour; this suggests that egg-production, under careful management, can be a remunerative enterprise on many farms.

From the management point of view, the writer highlights those aspects which have the greatest effect on profitability. The first is the total value of eggs produced, which depends not only on the quantity and quality of the eggs but also on the seasonality of production. The report notes that all producers surveyed missed the peak prices for large eggs from late September to late November.

On the cost side feeding is shown to be of prime importance, and here the conclusion is that several producers were not feeding sufficiently to utilize the full egg-laying potential of their hybrid birds. With a feed intake varying from 95–135 lb per bird, it seems that more attention should be paid to feeding, though this must of course be related to production. Flock depreciation is shown to be the second most important cost item. While there appears to be no best time for culling, the question is posed whether the policy of once-yearly replacement of stocks should not give way to a more continuous policy so that an even production of uniform eggs can be maintained.

While 1960-61 was a much better year for egg producers, they could still study the facts and implications of this report to advantage.

W.J.K.T.

Plant Pathology: Past, Present and Future. J. H. WESTERN. (Reprint of paper read to Leeds University, 27th February, 1961.) 2*s.* 6*d.*

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This inaugural lecture would make an agreeable introduction to the subject for any university student and for many a sixth-former, too. *I.W.P.*

ACKNOWLEDGMENT OF PHOTOGRAPHS

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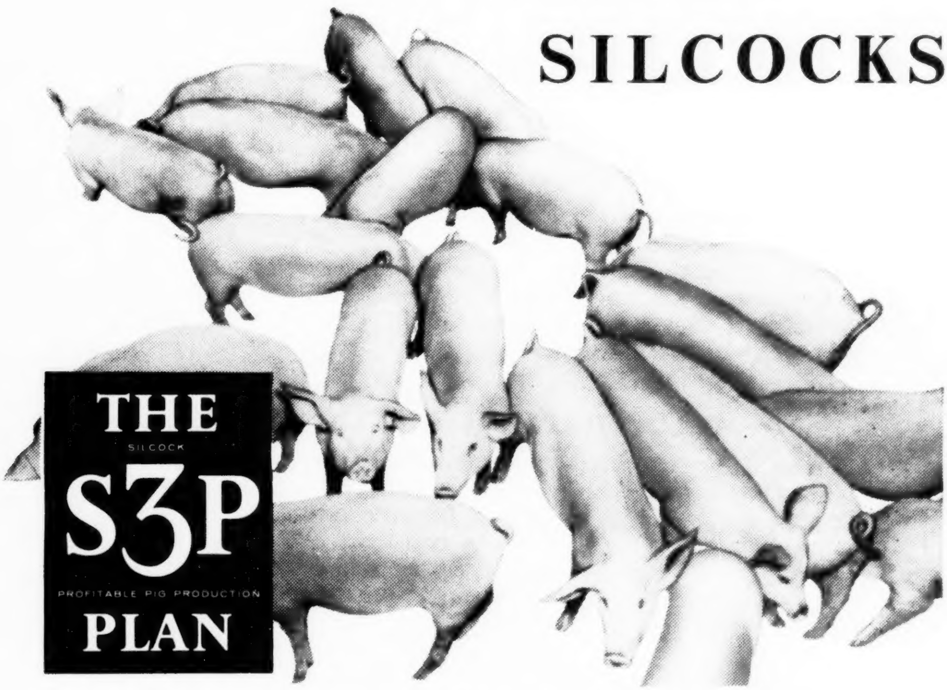

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